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U.S. Department of the Interior
Bureau of Land Management

in cooperation with the
U.S. Department of the Interior
Minerals Management Service

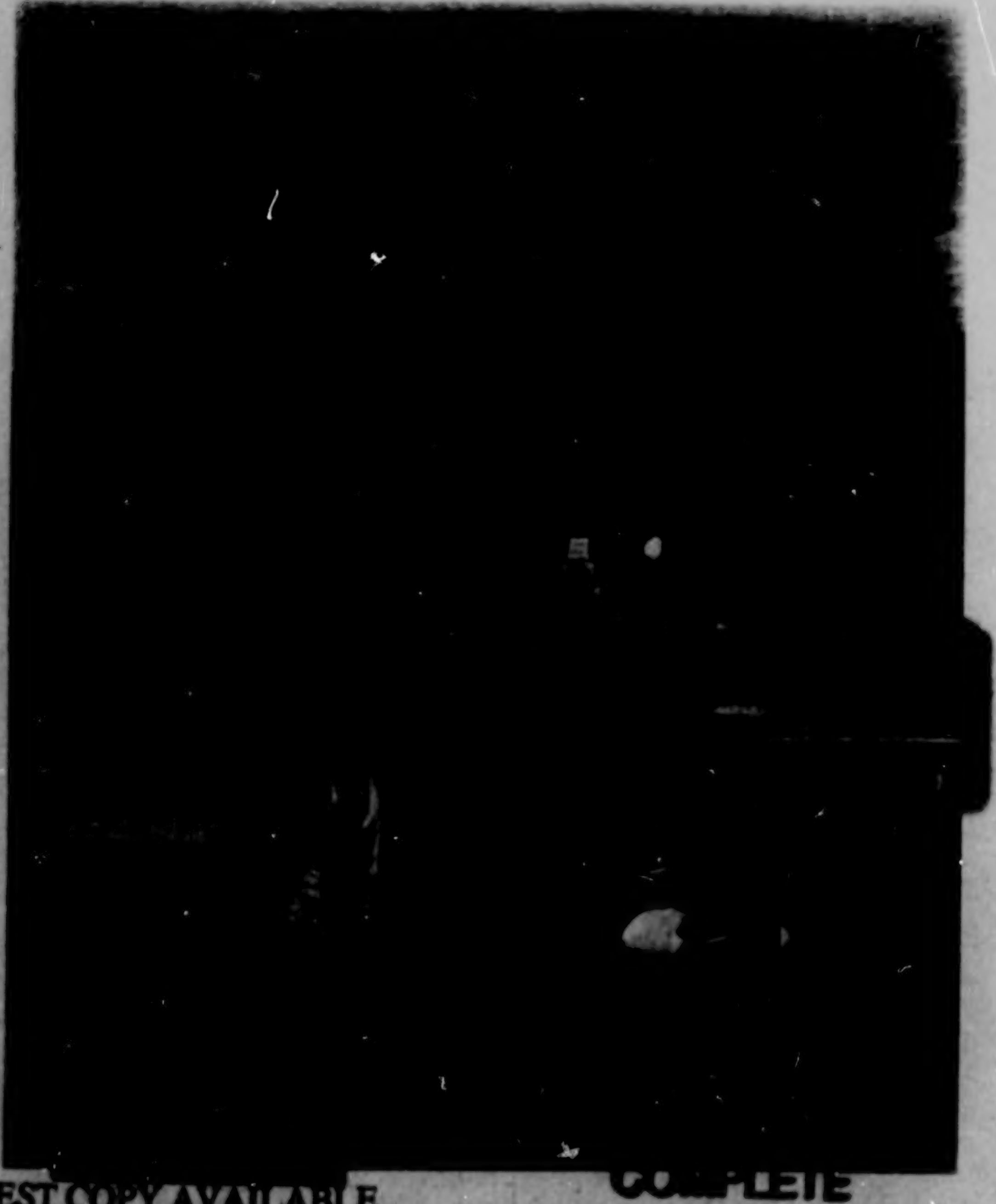
November 2003

Northwest National Petroleum Reserve-Alaska

FINAL Integrated Activity Plan/ Environmental Impact Statement

Volume 3

Appendices, Maps, Tables, Figures, Index



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The Bureau of Land Management Today

Our Vision
To enhance the quality of life for all citizens through
the balanced stewardship of America's
public lands and resources.

Our Mission
To sustain the health, diversity, and productivity of
the public lands for the use and enjoyment of
present and future generations.

Our Values
To serve with honesty, integrity, accountability, respect,
courage, and committment to make a difference.

Our Priorities
To improve the health and productivity of the land
to support the BLM multiple-use mission.

To cultivate community-based conservation,
citizen-centered stewardship, and partnership
through consultation, cooperation, and communication.

To respect, value, and support our employees,
giving them resources and opportunities to succeed.

To pursue excellence in business practices,
improved accountability to our stakeholders,
and deliver better service to our customers.

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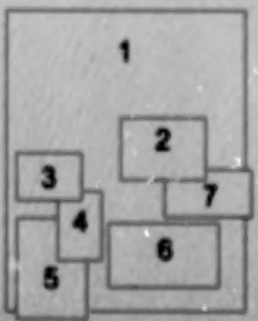

Cover photos:

1.	Roger Delaney	*Photo of Northwest NPRA*
2.	Edward Bovy	*Photo of drilling rig*
3.	BLM file photo	*Photo of Native Subsistence*
4.	BLM file photo	*Photo of Polar Bear*
5.	Dennis R. Green	*Photo of Caribou*
6.	© B. Randall/Vireo	*Photo of King Eider*
7.	Edward Bovy	*Photo of low-ground-pressure vehicle*

Northwest
National Petroleum Reserve-Alaska

Final
Integrated Activity Plan/
Environmental Impact Statement

Volume 3

Prepared by

U. S. Department of the Interior
Bureau of Land Management

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U. S. Department of the Interior
Minerals Management Service

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APPENDIX 1. INVENTORY AND MONITORING

During the life of this plan, inventory and monitoring would be used to 1) determine the status of the various resources within the area, 2) ensure compliance with plan decisions, 3) measure the effectiveness of the decisions, 4) ensure compliance with stipulations that are attached to land use authorizations, and 5) evaluate the effectiveness of the stipulations in accomplishing the purposes for which they were implemented. In the inventory and monitoring program, the greatest amount of attention would be given to those activities with the highest potential for environmental impact and those that are the most controversial. The program would be carried out in cooperation with the State of Alaska, Department of Fish and Game, the U.S. Department of the Interior, Fish and Wildlife Service, and the North Slope Borough (NSB), as appropriate and the results of these activities would be documented in reports.

The following discussion lists the primary objectives for and brief descriptions of the types of inventory and monitoring of the surface resources managed by the Bureau of Land Management (BLM) within the Northwest NPR-A Planning Area.

A. CULTURAL

Inventory and monitoring of cultural resources would be conducted primarily to ensure the preservation of all sites eligible for the National Register of Historic Places (National Register), as well as other important sites. Traditional knowledge is an important factor in the identification and interpretation that would go into compiling inventories of these sites. Inventories related to permitted development activities would focus on the cultural resources of specific locations, while inventories related to building a database of known sites would focus on more general areas--usually those expected to contain the highest numbers of cultural resources--such as good viewpoints, river banks, and game-concentration points. After a site is discovered through inventory/survey, it would be evaluated against criteria for nomination to the National Register to determine its level of significance. Many of these sites would be useful in the research, education, and interpretation that help to preserve the cultural heritage of North Slope residents.

B. LANDS

The primary objective of an inventory and monitoring program for lands is locating through survey and later conveying the Native Allotments and other entitlements that exist under the Alaska Native Claims Settlement Act (ANCSA). The secondary objective is to establish the location and ownership of existing structures--primarily cabins--within the Planning Area. This information would be used to evaluate potential conflicts between existing land uses and potential oil and gas exploration and development. This information would also be used in studies and efforts by the BLM, working with the NSB, to address those structures that are on Federal public lands without authorization from the BLM.

C. FISH

When necessary, inventory and monitoring of fish would establish baseline information on the populations of various species. For activities involving oil and gas exploration and development, agencies and disciplines would jointly create an issue-based, long-term monitoring program. This program would include monitoring and assessing the effectiveness of prescribed mitigating measures by means of limnological, biological, and physical habitat studies. Public-participation recreational and subsistence fisheries would also be monitored. See the subsistence discussion in paragraph G. below for a discussion of how fish inventory and monitoring and subsistence inventory and monitoring are related.

D. HAZARDOUS MATERIALS

The BLM would conduct and maintain an inventory of lands to identify currently unidentified hazardous materials sites and locations of past spills or dumps. The inventory/research process would include searching records, and interviewing local residents and government personnel. The BLM would also monitor oil and gas exploration and development activities to ensure compliance with permit requirements.

E. PALEONTOLOGY

Inventory and monitoring of paleontological resources would be conducted to ensure that every important site is preserved. Inventories related to development activities would focus on specific locations, while inventories related to building a database of known sites would focus on more general areas--usually those along the Colville and Ikpikpuk rivers--where concentrations of paleontological specimens are known to exist. After a site is discovered through inventory/survey, it is evaluated to determine its level of importance. Many sites would be useful in the research, education, and interpretation that help to preserve the cultural heritage of North Slope residents.

F. RECREATION

Commercial recreational use would be monitored for adherence to permit stipulations. The BLM would also monitor general recreation use that may occur within the Planning Area and on the adjacent rivers and sites where BLM has management jurisdiction. Monitoring would focus on both the impacts of recreation on other surface resources and the effects of activities, such as oil and gas exploration and development on recreational values. As part of the monitoring program, BLM may conduct visitor-use surveys to ascertain issues or areas of concern.

G. SUBSISTENCE

Inventory and monitoring would help to conserve healthy populations of fish and wildlife resources that are important for subsistence purposes. Data would be collected for caribou, moose, fish, furbearers, and various waterfowl. Incidental sightings of muskoxen and grizzly bears would provide data on these species. Data on population trends and distributions for all species and sex and age composition for caribou and moose would be of primary interest. Inventory and monitoring would also assist in better understanding the relationship of species to their habitat and the amount of habitat needed for individuals or breeding pairs.

For many residents of the North Slope, subsistence is the most important issue addressed in this document; concern about the possible effects of the management actions being considered in this document was a consistent theme during public meetings. One major recommendation that came out of a subsistence workshop panel held in Barrow and Nuiqsut as part of the planning process was the development of a subsistence-monitoring program. The inventory approach described here is a major part of that program. Under Alternatives A through C, the BLM would work with the Subsistence Advisory Panel and the NSB to develop a program to monitor the effects of oil and gas development on subsistence users.

H. VEGETATION

Inventory and monitoring are important strategies in meeting the objective of identifying key habitats for various wildlife species (such as waterfowl) and conserving populations of rare plant species. The BLM completed a digital land-cover classification of the study area in 1998 (Ducks Unlimited, 1998). This database will be analyzed in conjunction with other data on observed occurrence of wildlife species and known rare plant locations to identify possible correlations. This information will also be used to identify critical habitats, potential habitat expansion areas, or areas that are likely to sustain rare plants. These areas could then be sampled to determine the validity of the correlations and interpretations. Monitoring of vegetation would be conducted, through either remote sensing or on-the-ground studies, to detect any change over time. Site-specific surveys to locate populations of rare plants would be carried out ahead of any potential surface development.

I. WATER RESOURCES

Inventory and monitoring would help to provide the data necessary to minimize undue and unnecessary degradation of water resources within the Planning Area and adjacent watersheds. Inventories would identify the water-resource availability and requirements for the Planning Area and adjacent watersheds. Hydrology and limnology data would be correlated with critical aquatic habitat areas for fisheries and waterfowl. Both fieldwork and geographic information system (GIS) mapping would be necessary. Field studies would take the form of in-stream flow and stream-gauging in high-resource-value areas and the causes of change in water quality would be identified when possible.

J. WELL SITE MANAGEMENT

Previously drilled oil and gas exploration wells would be inventoried and evaluated to determine whether they should be plugged or left open to support ongoing research. Geographic positioning system (GPS) locations would be needed along with records of the location of wells in relation to major physiographic and human structures.

K. WILDLIFE

inventorying and monitoring of species are essential to managing lands for healthy wildlife populations. Federal, State, and NSB agencies focus their separate and joint inventory work in the Planning Area on certain species based on each agency's mission and the results of public interest assessment. Ongoing inventories in which BLM is a participant include caribou calving and the composition and movement of the Teshekpuk Lake herd, raptor breeding along the Colville River, and land birds breeding in the Umiat area. Funding permitting, BLM might participate in future inventory and monitoring of population demographics of spectacled eiders and Steller's eiders, moose, and muskoxen.

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Appendix 2. Summary and Comparison of Effects on Resources by Alternative

Summary and Comparison of Effects on Soils

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
The overall impact to soils of the Planning Area would be minor (with seismic operations) to negligible (without seismic operations).	**Effects of First Sale**: Soil stability depends closely on vegetative cover; where vegetation is disturbed, impacts on soils follow. Impacts from activities other than oil exploration and development would be negligible. Impacts from seismic surveys and winter exploration would be expected to be minor to negligible. Development activities would cause loss or disturbance of up to 790 acres of soils. The duration of these impacts would be permanent. Oil spills would be cleaned up immediately causing minimal contamination to soils.	**Effects of First Sale**: Impacts from activities other than oil exploration and development would be negligible. Impacts from seismic surveys and winter exploration would be minor to negligible. Development activities would cause loss or disturbance of up to 650 acres of soils. The duration of these impacts would be permanent. Oil spills would be cleaned up immediately causing minimal contamination to soils.	**Effects of First Sale**: Impacts from activities other than oil exploration and development would be negligible. Impacts from seismic surveys and winter exploration would be minor to negligible. Because no development is anticipate, no acres would be disturbed by development and impacts from spills would be limited to those associated with non-oil and gas and seismic activities.	**Effects of First Sale**: Impacts on soils follow. Impacts from activities other than oil exploration and development would be minor to negligible. Impacts from winter exploration and well drilling would be expected to be minor to negligible. Development would cause loss or disturbance of up to 600 acres of soils. The duration of these impacts would be permanent. Oil spills would be cleaned up immediately, causing minimal disturbance to soils. Impacts from development activities to soils would be minor to low.
	Effects of Multiple Sales: There will be little impact to soils from exploration activities. Development could permanently destroy soils on up to 1,530 acres.	**Effects of Multiple Sales**: Impacts to soils from exploration activities would be small to negligible, while development could permanently destroy soils on up to 1,260 acres.	**Effects of Multiple Sales**: Impacts from all but oil and gas development would be similar, though smaller, than those under Alternative A. No impacts from development are anticipated.	**Effects of Multiple Sales**: Little impact to soils is expected from exploration activities; impacts from development activities would disturb or result in the loss of small- to moderate-sized areas. The overall impact to soils would be negligible (with seismic) to moderate (with development).
Cumulative Effects: Oil and gas exploration and development and other activities on the North Slope have and will impact a very small fraction of the soils of the area.				

Summary and Comparison of Effects on Paleontological Resources

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts would be minimal (less than Alternative C) whether	**Effects of First Sale**: Impacts would be minimal. Measures are in place to ensure effective	**Effects of First Sale**: The risk of impacts to paleontological resources would be slightly	**Effects of First Sale**: The risk of impacts would be significantly reduced from that under	**Effects of First Sale**: Impacts from activities other than oil and gas exploration and development

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Summary and Comparison of Effects on Paleontological Resources

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
or no seismic activity is allowed.	mitigation of any potential impact that might result from the two disturbances most likely to impact paleontological values — mineral extraction (estimate 175 acres) or burial of gas pipelines.	reduced from those in Alternative A primarily because of increased constraints on development near lakes, streams, and rivers.	Alternative A because of increased constraints on development and the reduced area made available for oil and gas leasing.	would be minimal, regardless of the level of seismic activity. Potential impacts from first sale oil and gas exploration and development would probably be minor because of the environmental constraints that would be in effect.
	Effects of Multiple Sales: The risk of impacts may increase by a factor of two over that of the first sale, but impacts would still be minimal.	**Effects of Multiple Sales**: The probability of the occurrence of impacts should decrease slightly from that under Alternative A.	**Effects of Multiple Sales**: The risk of impacts would be significantly less than under Alternative A.	**Effects of Multiple Sales**: Impacts from activities other than oil and gas exploration and development would be minimal. The probability of impacts from exploration and development would increase somewhat because of the amount of land potentially impacted.
Cumulative Effects: With current procedures for survey and inventory prior to oil and gas exploration and development activities on the North Slope, the impact to the resource would be minimal.				

Summary and Comparison of Effects on Water Resources

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts would be minimal. Seismic activities may have short-term impacts on 7 to 30 acres and long-term (several years to several decades) on less than 3 acres. Without seismic activities, impacts to water resources would be negligible	**Effects of First Sale**: Seismic activities may have short-term impacts on 20 to 80 acres annually and long-term (several years to several decades) on 2 to 8 acres annually. The potential short-term impacts from exploration and delineation drilling would be water removal from up to 130 lakes and riverine pools, and during construction, increased water impoundments, diversions, thermokarst erosion, and sedimentation of up to 3,000 ac. Long-term impacts from development of gravel roads,	**Effects of First Sale**: Seismic activities may have short-term impacts on 15 to 60 acres annually and long-term (several years to several decades) on 2 to 6 acres annually. The potential short-term impacts, from exploration and delineation drilling would be water removal from up to 90 lakes and riverine pools, and during construction, increased water impoundments, diversions, thermokarst erosion, and sedimentation of up to 2,000 acres. Long-term impacts from development of gravel roads,	**Effects of First Sale**: Seismic activities may have short-term impacts on 7 to 30 acres and long-term (several years to several decades) on less than 3 acres. The potential short-term impacts, from exploration and development drilling would be water withdrawals from up to 40 lakes, and during construction, increased water impoundments, diversions, thermokarst erosion, and sedimentation of up to 350 acres. Long-term impacts from development of gravel roads, pads, and pits could impact up to	**Effects of First Sale**: Seismic impacts are expected to be minimal. Greatest long term Impacts from oil and gas development activities on the water resources in the Planning Area are from gravel roads, pads, and structures. The potential short-term impacts from exploration and delineation would be water removal from up to 90 lakes, and during construction, increased water impoundments, diversions, thermokarst erosion, and sedimentation up to 2,000 acres. Long-term impacts from

Summary and Comparison of Effects on Water Resources (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	pads, and pits could impact up to 1,500 acres.	pads and pits, could impact up to 1,000 acres.	200 acres. Alternative C protects areas of special aquatic resources, including areas adjacent to streams and lakes identified as critical aquatic habitat. Consequently, the potential adverse effects under Alternative C on water resources would be very much less than under Alternative A.	development could impact up to 1,000 acres. Overall impacts would be about 3,000 acres of short-term impacts and 1,500 acres of long-term impacts.
	Effects of Multiple Sales: Annual impacts from seismic activities would be the same as for the first sale. Although shared infrastructure could reduce impacts, overall impacts from other oil and gas activities could be double that for the first sale.	**Effects of Multiple Sales**: Annual impacts from seismic activities would be the same as for the first sale. Although shared infrastructure could reduce impacts, overall impacts from other oil and gas activities could be double that for the first sale.	**Effects of Multiple Sales**: Annual impacts from seismic activities would be the same as for the first sale. Although shared infrastructure could reduce impacts, overall impacts from other oil and gas activities could be double that for the first sale.	**Effects of Multiple Sales**: Seismic impacts are expected to be minimal. Impacts from oil and gas activities could be several times greater than impacts from a single sale. Indirect impacts might take years to develop. Short-term impacts include water removal of up to 1,800 acre/ft from 180 lakes for exploration and delineation drilling, increased water term impacts from development of gravel roads, pads, and pits could impact up to 2,000 acres from water impoundments, diversions, and thermokarst erosion. Shared infrastructure could reduce the adverse effects to water resources from multiple sales.

Cumulative Effects: Water use by North Slope villages and oil and gas activities will continue to draw from local surface water sources. Water is abundant on the North Slope and impacts are likely to be localized and minimal.

Summary and Comparison of Effects on Freshwater Quality

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
With or without seismic activities, impacts would be negligible.	**Effects of First Sale**: Seismic and exploratory activity would create short-term (usually one	**Effects of First Sale**: The short-term, localized impacts from seismic and exploratory activity	**Effects of First Sale**: The short-term, localized impacts from seismic and exploratory activity	**Effects of First Sale**: Seismic and exploratory activity would create short term (usually one season)

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Summary and Comparison of Effects on Freshwater Quality (continued)				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
Long-term water quality over a total of less than an acre would be affected by biannual seismic programs.	season) and localized effects on water quality. Long-term impacts from seismic activity would be less than an acre. Development gravel structures could result in hundreds of acres of impounded water for each production pad with resultant impacts on turbidity from erosion. Oil spills could result in water quality degradation along short stretches of some rivers for a few weeks and about 7 ponds or small lakes could become toxic to sensitive species for about 7 years.	would be reduced approximately one third and one quarter, respectively, compared to Alternative A. Long-term impacts from seismic would he slightly less than for Alternative A. Impacts from impoundment of water would be one quarter less than for Alternative A. Oil spills could degrade water quality along short stretches of some rivers for a few weeks, and cause about 6 ponds or small lakes to become toxic to sensitive species for about 7 years.	would be reduced approximately one third and one quarter, respectively, compared to Alternative A. Long-term impacts from seismic would be less than Alternative B and equivalent with the No Action Alternative.	and localized effects. Short-term (year-or-more) effects would occur from winter extraction of unfrozen water from over 900 acreft of nearby lakes. Gravel construction would cover about 400 acres. Docks or staging areas could cover up to 400 more acres. Gravel construction can result in upslope water impoundment and thermokarst erosion equivalent to twice the area directly covered by gravel. Long-term (decade-or-more) effects from development of gravel roads, pads, and pits could occur on nearly 1,000 acres. Oils spills could degrade water quality over the course of a few weeks along a short stretch of nearby rivers and lakes and cause about 6 ponds or small lakes to remain toxic to sensitive species for about 7 years.
	Effects of Multiple Sales: Long-term (decade-or-more) effects of multiple sales would be slightly greater than for a single sale. Oil spills could result in waters of up to 9 ponds or small lakes remaining toxic to sensitive species for about 7 years.	**Effects of Multiple Sales**: Long-term (decade-or-more) effects of multiple sales would be similar to those for a single sale. Oil spills could result in waters of about 8 ponds or small lakes remaining toxic to sensitive species for about 7 years.	**Effects of Multiple Sales**: Long-term (decade-or-more) effects of multiple sales would be slightly greater than for a single sale.	**Effects of Multiple Sales**: Short-term effects of multiple sales would be similar to those for a single sale. Long-term effects of multiple sales are assumed to double over that of a single sale. Indirect impacts may take years to develop. Water quality could be affected on up to 2,000 acres from water impoundments, diversions, and thermokarst erosion. Oil spills could result in waters of about 8 ponds or small lakes remaining toxic to sensitive species for about 7 years.

Summary and Comparison of Effects on Freshwater Quality (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Cumulative Effects: Oil and gas activities may produce short-term local impacts to water quality. Oil spills can create short and long-term impacts to surface water. A crude oil spill from a tanker could cause short-term water quality impacts to saltwater along the tanker routes south of Valdez.				

Summary and Comparison of Effects on Estuarine Water Quality

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts to estuarine water quality under the No Action Alternative are expected to be negligible, whether or not seismic exploration activities are allowed in the Planning Area.	**Effects of First Sale**: Effects of regulated discharges would be negligible. The effects of gravel-island construction and buried-pipeline construction would probably be temporary and minor, especially for facilities along the naturally turbid Beaufort Sea coast. Short docks and causeways in bays would probably not affect hydrologic conditions, but long causeways with inadequate breeches would probably have measurable, long-term impacts on hydrologic conditions. Site-specific effects could be further reduced through additional mitigation developed as a result of additional NEPA assessments. If a large spill occurred during the ice-covered season, the effects would be minor; if it occurred during the open-water or broken ice seasons, hydrocarbons dispersed in the shallow estuarine water column could exceed the 1.5-ppm acute (toxic) criterion during the first day in the immediate vicinity of a spill. Because of the difficulty of	**Effects of First Sale**: Effects of regulated discharges and of disturbance due to permitted construction would be similar to those under Alternative A, except in Kasegaluk Lagoon, which would be excluded from leasing so there would be no effects. Winter spill effects on estuarine water quality would be similar to those under Alternative A, but open-water spill effects would be much lower than with Alternative A.	**Effects of First Sale**: There would be a greatly reduced risk of spills, but still a slight chance of them in NPR-A bays for two reasons — fuel might be transported across the bays for onshore exploration and there might be further State and Federal leasing of adjacent offshore waters.	**Effects of First Sale**: Discharges of drilling and human waste would be prohibited estuaries; no unregulated discharges of produced water would be allowed; and no adverse effects on kelp or special benthic communities from construction of ice islands or ice roads are expected. The effects of gravel-island construction and buried-pipeline construction would probably be minor and temporary. A short dock or jetty in estuarine waters probably would not affect hydrologic conditions, but a long causeway with inadequate breeches would probably have measurable, long-term impacts. If a large spill occurred during the open water season, formed a slick, or became dissolved in the water column, it could contaminate approximately two-thirds of the coastline in an estuary like Admiralty Bay, and the hydrocarbon concentration might exceed the 0.015-ppm chronic criteria for up to 30 days in an area that ranges up to 70 mi^2 (180 km^2). Effects probably would not extend outside the estuaries unless the

Summary and Comparison of Effects on Estuarine Water Quality (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	responding to open-water and broken-ice spills, the level of effects for Alternative A, which would not restrict offshore drilling to the ice-covered season, would be slightly greater than for other alternatives.			spill involved fuel at a coastal staging site, such as Cape Simpson. Stipulations G-1 and K-3 might be effective at moderating the effects of long causeways and estuarine spills.
	Effects of Multiple Sales: The effects of multiple sales on estuarine water quality would probably be slightly less than twice that for the first sale.	**Effects of Multiple Sales**: The effects of multiple sales on estuarine water quality would probably be slightly less than twice that for the first sale.	**Effects of Multiple Sales**: Multiple sales would have very low level of effects on estuarine water quality, similar to the effects from the first sale.	**Effects of Multiple Sales**: The effects of multiple sales on estuarine water quality would probably be slightly less than twice that for the first sale.
Cumulative Effects: The types of impacts would be similar to those described for the Planning Area under Alternative A, but would occur in a more widely dispersed area of the North Slope witnessing oil and gas activities. The effects of regulated discharges would be negligible. The effects of gravel-island construction and buried-pipeline construction would probably be temporary and minor, especially for facilities along the naturally turbid Beaufort Sea coast. Short docks and causeways would probably not affect hydrologic conditions, but long causeways with inadequate breeches have and in one case would probably continue to have measurable, long-term impacts on hydrologic conditions. If a 500- to 900-bbl spill occurred during the ice-covered season, the effects would be minor. If it occurred during the open-water or broken ice seasons, hydrocarbons dispersed in the shallow estuarine water column could exceed the 1.5-ppm acute (toxic) criterion during the first day in the immediate vicinity of a spill.				

Summary and Comparison of Effects on Air Quality

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Concentrations of criteria pollutants would remain well within Federal air-quality standards. The overall effects on air quality would be minimal.	**Effects of First Sale**: Activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the Prevention of Significant Deterioration Class II limits and National Ambient Air Quality Standards. Therefore, effects would be low.	**Effects of First Sale**: The effects would be essentially the same as Alternative A.	**Effects of First Sale**: The effects would be essentially the same as No Action Alternative.	**Effects of First Sale**: Development and production activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the Prevention of Significant Deterioration (PSD) Class II limits and National Ambient Air Quality Standards (NAAQS). Therefore, effects would be low.

Summary and Comparison of Effects on Air Quality (continued)				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
	Effects of Multiple Sales: The effects for multiple sales would be essentially the same as those above for the first sale effects would remain low.	**Effects of Multiple Sales**: The effects for multiple sales would be essentially the same as those above for the first sale effects would remain low.	**Effects of Multiple Sales**: The effects for multiple sales would be essentially the same as those above for the first sale — effects would remain low.	**Effects of Multiple Sales**: Effects of all activities under all sales would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and NAAQS. Therefore, effects would be low.
Cumulative Effects: The cumulative effects of all projects affecting the air quality of the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. All reasonably foreseeable North Slope projects would not change this situation.				

Summary and Comparison of Effects on Vegetation				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
Impacts would be negligible without seismic exploration. With seismic exploration, from 0.1 to 2.0% (11,300 to 183,100 acres) of the Planning Area would be affected every other year. Complete recovery could vary from a year to decades. This would be a minor impact to vegetation communities, though if a moderate to high level of disturbance occurred in the area of a population of one of the rare plant species, the effect on that particular taxon could be moderate to severe.	**Effects of First Sale**: Impacts from activities other than oil and gas exploration and development would involve a small fraction of the Planning Area. The overall impact from non-oil and gas activities would be minor to negligible. The impacts of oil and gas exploration would include vegetation disturbance on 0.3 to 6% (33,800 to 549,000 acres) of the Planning Area per year from 2-D and 3-D seismic surveys. Ice roads and pads could impact <870 acres per year. Development could permanently destroy vegetation on <790 acres and alter plant species composition of <2,220 acres. Unless these impacts occurred to a rare plant species, these impacts would not likely adversely affect any plant species or community. Small oil	**Effects of First Sale**: Impacts from activities other than oil and gas exploration and development would be slightly less than for Alternative A. The impacts of oil and gas exploration and development would be the same types as for Alternative A, but would affect fewer acres and may be shifted away from marsh and riparian wetland habitats. Seismic surveys could affect 0.2 to 4% (22,500 to 366,000 acres) of the Planning Area per year. Construction of ice roads and ice pads would annually impact <420 acres and <170 acres, respectively. Development could involve destruction of vegetation on <650 acres and the alteration in plant species composition of <1,950 acres. Unless these impacts occurred to a rare plant species, these impacts would not	**Effects of First Sale**: Impacts from activities other than oil and gas exploration and development would be slightly less than for other alternatives. The impacts of oil and gas exploration would be of the same types as for Alternative A, but would affect fewer acres and be less likely to affect marsh and riparian wetland habitats. Seismic surveys could disturb 0.1 to 2% (11,000 to 183,000 acres) every other year Construction of ice roads and ice pads could affect <210 acres and <35 acres, respectively. Small oil spills could occur during seismic surveys and exploratory drilling, but would affect much less vegetation than under the other alternatives.	**Effects of First Sale**: Impacts from activities other than oil exploration and development would involve disturbance or destructive impacts to a small fraction of the Planning Area, and overall impacts would be minor to negligible. Impacts from oil exploration would include vegetation disturbance on 22,500 to 366,000 acres per year from seismic surveys. About 25 percent of the disturbance would be at a medium to high level. After 9 years, recovery would be about 90 percent. Ice road construction would have impacts on < 420 acres/year and ice pads on < 170 acres. Exploration activities would cause permanent, minor vegetation destruction and alteration from the construction of exploration well cellars.

Summary and Comparison of Effects on Vegetation (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	spills could affect <3 acres and would cause minor ecological damage, and ecosystems would be likely to recover in a few years to 2 decades.	likely adversely affect any plant species or community. Oil spills would affect <4.3 acres of vegetation within the Planning Area.		Development activities would cause the destruction of vegetation on ≤ 650 acres and the alteration in plant species composition on ≤ 1,915 acres, affecting a total of over ≤ 2,565 acres. These impacts would be permanent if gravel pads remain after production ends, although some plant species would be able to grow on the pads. Development impacts would affect less than 0.03 percent of the total Planning Area and would not likely adversely affect any plant species or community. If a development facility were to be placed over a rare plant population, the effects on that taxon could be severe. However, it is expected that rare plants colonies would be avoided through careful siting at the facilities-approval stage. Oil spills during exploration and development would affect < 4.3 acres of vegetation. Spills would be cleaned up immediately, causing minor ecological damage, and ecosystems would likely recover in a few years to 2 decades.
	Effects of Multiple Sales: Compared to the impacts of the first sale, there would be a small increase in the amount of disturbance from seismic activities that would be evident at any one time. Up to 2,090 acres around and under ice pads and	**Effects of Multiple Sales**: There would be a small increase in the amount of disturbance from seismic activities that would be evident at any one time compared to that described for the first sale. Up to 1,940 acres around and under ice pads and	**Effects of Multiple Sales**: There would be a small increase in the amount of disturbance from seismic activities that would be evident at any one time compared to that described for the first sale. Up to 250 acres around and under ice pads and	**Effects of Multiple Sales**: Impacts from exploration would include about double the vegetation disturbance from seismic work expected for a single-sale. The extended period of time over which it would occur--coupled with the recovery time for disturbed areas--

Summary and Comparison of Effects on Vegetation (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	roads could be disturbed. Development activities could cause the destruction of vegetation on <1,530 acres and the alteration in plant species composition of <4,660 acres. Oil spills could affect <10 acres of vegetation within the Planning Area. Recovery from spills would take a few years to two decades.	roads could be disturbed. Development activities from all lease sales would cause the destruction of vegetation on <1,260 acres and the alteration in plant species composition of <4,050 acres. Oil spills would affect <8.6 acres of vegetation within the Planning Area.	roads could be disturbed. Refined oil spills from seismic activities would remain at about the same level as for the first sale, and would be about one-sixth the level as under Alternative A. Spills during exploratory and delineation drilling would roughly triple from the level of a single sale, but would impact much less than the <10 acres affected under Alternative A multiple sales.	would result in a small increase in the amount of visible disturbance. Exploration activities would cause < 0.03 acres of permanent vegetation destruction around well cellars and alteration of < 1,940 acres/year around and under ice pads and roads. The combined effect of exploration and development activities over all lease sales would cause the destruction of vegetation on ≤ 1,260 acres and the alteration in plant species composition on ≤ 4,050 acres, for a total of ≤ 5,310 acres. These impacts would be permanent if gravel pads remain after production ends. Impacted areas (3,920 acres) represent about 0.04 percent of the total land cover, and, as such, they would not be likely to adversely affect any plant species or community. If a development facility were to be placed over a rare plant population, the effects on that taxon could be severe. Careful siting of facilities after site-specific environmental analysis is expected to avoid and protect rare plant species. Oil spills would affect < 8.6 acres of vegetation; recovery would take a few years to 2 decades.
Cumulative Effects: Human-caused impacts are expected to be additive in nature; no synergistic or countervailing impacts are anticipated. The areal extent of impacts would constitute a very small fraction of the total North Slope acreage. Global climate change could alter the species composition, increasing deciduous shrubs and decreasing sedges and grasses.				

Summary and Comparison of Effects on Fish				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
No measurable effects on arctic fish are anticipated	**Effects of First Sale**: A small number of individual fish may be killed, but it is unlikely that there would be a measurable effect on arctic fish populations. Increased mortality is anticipated if water withdrawals occur in river pools, though it is unlikely that the entire population within a river system would be eliminated. Gravel extractions can lead to habitat enhancement under certain situations.	**Effects of First Sale**: The activities and type of effects expected from exploration and construction are similar to those under Alternative A. Reduced water (30% reduction) and gravel (20% reduction) needs would result in less impact to fish.	**Effects of First Sale**: The activities and type of effects expected from exploration are similar to those under Alternative A, but a 71% decrease in water needs in exploration, a prohibition on water withdrawals from rivers, and the projected lack of development would result in less impact to fish.	**Effects of First Sale**: Non-oil and gas activities, seismic surveys, causeways, and seawater spills are not expected to have measurable effects on arctic fish populations. Construction of pads, roads, and airstrips, and fuel spills might be expected to kill a small number of individual fish, but are expected to have no measurable effect on arctic fish populations. Potential mortality from water withdrawals in lakes is possible although limits on withdrawal and monitoring of water quality should minimize effects. Gravel extractions can lead to habitat enhancement under certain situations. Potential mitigation measures address water withdrawal in rivers and lakes and gravel extraction.
	Effects of Multiple Sales: Impacts may be greater than under the first sale, but would remain minor.	**Effects of Multiple Sales:** Impacts may be greater than under the first sale, but would remain minor.	**Effects of Multiple Sales:** Impacts may be greater than under the first sale, but would remain minor.	**Effects of Multiple Sales:** Seismic surveys and pipelines from multiple sales are expected to have the same overall effect on arctic fish populations for the first sale. Production pads and roads are expected to have about twice the effect as for first sale. Fuel and oil spills are likely to have a greater, though still minor, effect on arctic fish populations. Insufficient recovery time between sales and/or greater levels of activity would likely result in

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Summary and Comparison of Effects on Fish (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				greater effects than those estimated here for multiple sales.
Cumulative Effects: Increased wide-range impacts to freshwater fish populations are not anticipated based on the cumulative analysis. Offshore oil spills that enter coastal waters are expected to affect a greater percentage of marine and anadromous fish than estimated for Alternative A. Assuming sufficient recovery time between spills, the recovery from a spill is expected within 3 to 5 years.				

Summary and Comparison of Effects on Birds

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Disturbance in the vicinity of large summer camps, including air support, minor impact on uncommon, decreasing, or recently declined species at the ACP-population level. A large camp could have an elevated effect at the local level on declining species. Effects may be difficult to separate from natural variation in population numbers. Impacts of other activities would be negligible.	**Effects of First Sale**: Impacts from non-oil and gas activities would be similar to those for the No Action Alternative. Effects of summer air traffic and gravel mining that eliminates breeding habitat of declining species is likely to be minor. Crude oil spills confined to terrestrial and freshwater aquatic habitats could have a minor effect by killing a few waterfowl, shorebirds, raptors, and passerines. Impacts would be more serious, potentially elevated to moderate level, if a spill enters a river delta or nearshore marine habitats occupied by loons, large numbers of seaducks whose populations have declined, black guillemots, or Ross s gulls.	**Effects of First Sale**: Impacts would be similar to those described for Alternative A, except that effects on marine and river delta birds would be reduced.	**Effects of First Sale**: Impacts from non-oil and gas activities would be similar to those for the No Action Alternative. All other impacts are likely to be negligible.	**Effects of First Sale**: Disturbance effects from non-oil and gas activities are likely to be negligible for most local and regional bird populations. Elevated activity and air traffic near large summer camps could result in minor impacts on local populations. Regional populations are expected to experience negligible effects, except those species that are uncommon, decreasing, or recently declined, where a minor effect may occur. Routine summer air traffic, especially over higher bird density areas, is likely to result in minor impacts. Gravel mining, pads, airstrips, short pad-connecting roads, and pipelines, although eliminating small areas of breeding habitat and displacing small numbers of nesting birds, are likely to result in negligible population effects. Raptors nesting along major rivers are expected to experience negligible effects from disturbing activities. Effects from crude oil spills when confined to

Summary and Comparison of Effects on Birds (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				terrestrial and freshwater aquatic habitats could go from negligible for most species to minor for rare species or those with declining populations. If a spill were to enter a river delta or nearshore marine habitats occupied by substantial numbers of birds, minor to moderate effects would be likely for stable/increasing and declining species populations, respectively. Effects (including disturbance) on species utilizing Kasegaluk Lagoon and the western Planning Area (particularly those with substantial numbers of post-breeding individuals concentrating in the lagoon, e.g., brant, king eider, common eider) could be lower under the Preferred Alternative than under Alternative A because of designation of Kasegaluk Lagoon as a Special Area and the 10-year leasing deferral. Quantitative effects might be difficult to separate from natural variation in population numbers.
	Effects of Multiple Sales: Although most effects that are likely to occur throughout the Planning Area are expected to be short-term and negligible or minor, moderate effects could occur if concentrations of particularly vulnerable species, declining or with small or sensitive populations were to be involved. Increased numbers of	**Effects of Multiple Sales**: Effects of multiple sales could elevate the overall probability of disturbance and spill occurrence above that of the first sale. This likely would result in a corresponding increase in the potential for disturbing breeding birds, and for spilled oil to reach waterfowl or other water bird concentration areas and cause	**Effects of Multiple Sales**: If multiple sales result in more seismic surveys in the remaining available area, effects may be elevated to minor for species with small or declining populations, such as gyrfalcon and snowy owl. In addition, multiple sales could elevate the overall probability of disturbance on leased lands, thereby	**Effects of Multiple Sales**: Displacement of birds from disturbance and habitat alteration or loss would be expected to increase substantially if development and production facilities were located in a limited region of higher resource potential. Such development potentially could alter local populations in these areas. For species that

Summary and Comparison of Effects on Birds (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	spills are expected to result in the loss of substantial numbers of birds. These losses may not be detectable above the natural fluctuations of the population and survey methods/data available. Overall effect likely would increase from that discussed for the first sale if developments occurred in portions of the Planning Area where distributions of two or more vulnerable species overlap.	mortality.	increasing the potential for disturbing over-wintering birds above that of the first sale.	appear more vulnerable to habitat changes or disturbance (e.g., loons, eiders, raptors) effects could extend to regional populations and involve long-term changes in distribution. Although most likely effects are expected to be short-term and negligible to minor, moderate effects could occur if concentrations of several particularly vulnerable species — those with declining or small or sensitive populations--were to be involved. The likely increase in small crude and refined oil spills would be expected to elevate losses of birds somewhat during development. Subsequent recovery of cumulative lost productivity and recruitment may not be detectable above the natural population fluctuations. Multiple sales effects are expected to be additive to those of the first sale, and may range from a slight increase to a doubling or tripling of effects.

Cumulative Effects: Cumulative effects of oil-industry activities on birds potentially could be substantial in the case of loons and waterfowl species and significant in the case of long-tailed duck and king and common eiders — primarily as a result of mortality in the unlikely event a large oil spill were to occur. Although the chance of oil spill occurrence is relatively small, the potential for contact with bird concentrations would be highest in the vicinity of primary support facilities. As a result of the apparent decline in populations of some species, and the challenge of recovering spilled oil, particularly in broken-ice conditions, there is uncertainty regarding the ultimate effect of any spills on bird populations. None of the typical management or industrial activities discussed in this analysis is likely to cause significant population effects.

Summary and Comparison of Effects on Terrestrial Mammals

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
The effects are expected to be local and short term, with no significant adverse effects on mammal populations.	**Effects of First Sale**: Non-oil and gas activities are expected to increase somewhat compared to the No Action Alternative, but the increase is not expected to significantly affect terrestrial mammal populations. Some TLH caribou are expected to be disturbed and their movements delayed along an elevated pipeline to Kuparuk during periods of air traffic and construction. Near the oil fields, surface, air, and foot traffic is expected to displace some terrestrial mammals. If field development occurs in critical TLH insect-relief areas, movements of caribou from coastal insect-relief areas to foraging areas may be adversely affected. Extensive development could result in the loss of some insect-relief habitat for TLH caribou. Crude oil and fuel spills are expected to result in the loss of small numbers of terrestrial mammals.	**Effects of First Sale**: Impacts would be similar to but somewhat less than those projected under Alternative A.	**Effects of First Sale**: Impacts from non-oil and gas activities and seismic and exploratory oil and gas activities would be similar to but less than those projected under Alternative A. If, as projected, no development occurs, there would be no impacts from oil and gas development. If development occurs, the type of impacts would be similar to those under Alternative A, but much less in magnitude because many of the sensitive habitats would not be leased.	**Effects of First Sale**: Non-oil and gas activities, seismic work, exploration wells, and spills would have minor effects on terrestrial mammals. Projected levels of oil and gas development would result in increased disturbance of caribou and other terrestrial mammals. Some TLH caribou would be expected to be disturbed from increased habitat alteration and their movements delayed along the pipeline during periods of air traffic and construction. Near oil fields, surface, air, and foot traffic would be expected to displace some terrestrial mammals. If extensive development were to occur in the TLH insect-relief area, movements of caribou from coastal insect-relief areas to foraging areas would be disrupted to some extent. This effect would be minimized by locating and designing oil and gas facilities to allow for free movement of caribou. Within the Caribou Study Area, a study of caribou movements would be undertaken before facility development to better reduce development impacts on caribou movements. Extensive development in this area could result in the functional loss of some insect-relief habitat for TLH caribou. Activities under the Preferred Alternative are not expected to significantly affect

Summary and Comparison of Effects on Terrestrial Mammals (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				terrestrial mammal populations.
	Effects of Multiple Sales: The effect of multiple sales is expected to increase disruption of TLH caribou movements to insect-relief areas along the coast and to cause some disruption of CAH and WAH caribou. Impacts to grizzly bears, moose, wolves, and wolverines would be greater, as development would be located in higher density habitats for these species.	**Effects of Multiple Sales**: Impacts would be similar to that those discussed for multiple sales under Alternative A, but somewhat less in extent as fewer fields would be developed.	**Effects of Multiple Sales**: Disturbance associated with multiple sales could result in increased local effects, particularly to species of limited range, over that expected from the first sale, especially if sales are concentrated in particular portions of the remaining Planning Area. However, the overall effect of routine oil and gas activities at the regional population level is likely to be negligible.	**Effects of Multiple Sales**: Impacts would be expected to increase disruption of TLH caribou movements within insect-relief areas and cause some disruption of CAH and WAH caribou. Impacts to grizzly bears, moose, wolves, and wolverines would be greater as more development would be located in higher density habitats for these species.

Cumulative Effects: Cumulative oil and gas development on the North Slope could result in a long-term displacement and/or functional loss of habitat for CAH, TLH, and WAH caribou. At present, cumulative oil development in the Prudhoe Bay-Kuparuk area has caused displacement of CAH caribou from a portion of the calving range, with a shift in calving distribution away from the oil fields. Calving by TLH caribou may be reduced near the pipeline corridors; this would represent a long-term (several-generation) effect on the distribution of the TLH caribou. The alteration of >8,000 acres of tundra habitat in the Prudhoe Bay area has not had any apparent effect on the distribution and abundance of other terrestrial mammals, with the possible exception of arctic foxes, which have apparently increased in numbers near the oil fields. The variance in cumulative impacts among the alternatives would be that associated with the alternatives. Particularly notable is the reduced impacts to the TLH under the No Action Alternative and Alternative C, which would not allow development in the TLH insect-relief habitat.

Summary and Comparison of Effects on Marine Mammals

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts would be local and short term and could be lethal to a small number of animals, with no significant adverse effects to the populations	**Effects of First Sale**: Short-term impacts would occur within about 1 mi of resource-inventory-survey activities, survey and recreational camps, and overland moves. Oil and gas-associated noise, exploration, and potential spills would produce local impacts, which for a small number of animals (more than for the No Action Alternative) may be lethal. Overall impacts,	**Effects of First Sale**: Impact type and level would be similar to those for Alternative A	**Effects of First Sale**: Effects would be similar to those for the No Action Alternative	**Effects of First Sale**: Effects from activities other than oil and gas on marine mammals are expected to be local. Effects of oil and gas activities are expected to result in an increase in potential noise and disturbance along the coast, primarily in the Dease Inlet-Elson Lagoon Area, and these effects are expected to be local and short term (generally < 1 year or intermittent). Seals and polar bears

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Summary and Comparison of Effects on Marine Mammals (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
	however, are expected to be short term, with no significant adverse effects on populations.			could be affected by development offshore or along the coast in the Dease Inlet Area; effects would be local and are not likely to affect marine mammal populations. Potential oil spills are likely to affect small numbers of marine mammals with population recovery expected within 1 year. A small number of seals and polar bears might be adversely affected or killed by an onshore crude-oil spill if it contaminated Dease Inlet, or by small fuel spills occuring in and contacting Dease Inlet and Elson Lagoon; these losses would not be significant to marine mammal populations. Overall effects are expected to be short term, with no significant adverse effects on marine mammal populations
	Effects of Multiple Sales: Impacts would be about the same as for a single sale, but the duration and extent of impacts may increase.	**Effects of Multiple Sales**: Impacts would be about the same as for a single sale, but the duration and extent of impacts may increase.	**Effects of Multiple Sales**: Impacts would be about the same as for a single sale, but the duration and extent of impacts may increase.	**Effects of Multiple Sales**: Overall impacts would be about the same as for a single sale, but the duration and extent of activities and disturbance effects would be over a longer period.
Cumulative Effects: Absent a very large spill, impacts would be minor, primarily from brief and local noise and attraction to development facilities. A large oil spill in the arctic marine environment could kill 10 polar bears, a few hundred seals and walruses, and small numbers (probably less than 10) of beluga and gray whales; populations would likely recover within 1 year. Potential oil spills along the tanker route to the U.S. west coast could have long-term (more than one generation or perhaps 5 to 10 years) effect on sea otters and perhaps harbor seals and other marine mammals.				

Summary and Comparison of Effects on Endangered and Threatened Species

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Most impacts would be negligible, though	**Effects of First Sale**: Impacts from non-oil and gas activities	**Effects of First Sale**: The effects are similar to those	**Effects of First Sale**: The effects are similar to those	**Effects of First Sale**: Impacts from non-oil and gas activities, oil

Summary and Comparison of Effects on Endangered and Threatened Species (continued)

No Action	Alternative A	Alternative B	Alternative C	[illegible]
disturbance in the vicinity of large summer camps, and potentially also from smaller camps occupied for extended periods, could affect local nesting eiders and have a minor impact at the ACP population-level for spectacled eider population.	would be similar to those for the No Action Alternative. Impacts of oil and gas development generally would be negligible for bowhead whales and minor for eiders, though if a spill enters a nearshore staging area impacts to spectacled eiders may be more significant because the species population has recently experienced a sharp decline.	described for Alternative A. Both disturbance and oil-spill effects could be somewhat less than for Alternative A as a result of removal of Kasegaluk Lagoon from oil and gas leasing.	described for Alternative A, though impacts from oil and gas development would be less likely to occur because less exploration would occur, development is not projected to occur, and leasing would avoid much of the habitat of these species.	and gas transport, and seismic surveying may cause temporary avoidance behavior in bowhead whales. Effects from such exposures are likely to be short-term and negligible. Disturbance of eiders from aerial surveys, small summer camps, spill removal, river transport, winter ground transport, seismic surveying, and gravel mining are likely to be short-term and localized and result in negligible effects. Aircraft over flight effects on eiders are likely to be temporary and non-lethal. Reduction of breeding habitat by gravel mines, pads, roads, airstrips, and pipelines is likely to result in negligible population effects. Elevated activity and air traffic near large summer camps may result in minor impacts on both local and regional populations of eiders. Routine summer air traffic is likely to result in minor impacts. Depending on the nature and duration of behavioral changes caused by disturbance, such effects could be considered a "take" under the ESA. Effects from crude oil spills are expected to be minor when confined to terrestrial and freshwater aquatic habitats where mortality of eiders is likely to be relatively low. Minor to moderate effects are likely for eider

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Summary and Comparison of Effects on Endangered and Threatened Species (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				populations if a spill were to enter a river delta or nearshore marine habitats during a period when occupied by substantial numbers of brood-rearing, staging or migrating individuals. There is a potential for significant impacts in these circumstances. Quantitative effects may be difficult to separate from natural variation in population numbers. Stipulations would decrease disturbance from most factors for threatened eiders and help prevent fuel and oil pollution and degradation of important bird habitats. Overall effects on eiders could be somewhat less than Alternative A. Designation of Kasegaluk Lagoon as a Special Area and the 10-year leasing deferral could reduce potential risk to eiders that use this area prior to proceeding to molting areas in fall.
	Effects of Multiple Sales: Impacts could increase substantially from that discussed for the first sale if developments were concentrated in a limited area.	**Effects of Multiple Sales**: The effects are similar to those described for multiple sales for Alternative A.	**Effects of Multiple Sales**: Given that oil and gas development is not likely to occur, impacts would be similar to those for the first sale.	**Effects of Multiple Sales**: Displacement of eiders by disturbance and habitat alteration or loss is expected to increase substantially if production facilities are concentrated in areas with high eider densities. Such concentration could alter local populations in these areas. Steller's eiders may be particularly vulnerable to habitat changes or disturbance in the vicinity of nesting areas south of Barrow. Effects could extend to regional populations and involve

Summary and Comparison of Effects on Endangered and Threatened Species (continued)				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
				long-term changes in distribution. Effects are expected to be short-term and negligible to minor. Moderate effects could occur if eider concentrations were contacted frequently by oil spills. Although losses and subsequent recovery of cumulative lost productivity and recruitment may not be detectable above the natural population fluctuations, they are considered significant for these ESA-listed species. Effects from additional leasing are expected to be additive to those of the first sale, and to range from a slight increase to a doubling or tripling of effects.
Cumulative Effects: Overall, exposure of bowhead whales to noise from oil and gas operations is not expected to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects; prolonged exposure to freshly spilled oil could kill some whales. The effects from normal oil and gas activities in the Planning Area and adjacent marine areas are expected to include the loss of small numbers of eiders, particularly spectacled eiders, through disturbance effects on survival and productivity, and collisions with structures. Recovery from any short-term losses could be hindered by lowered productivity resulting from natural occurrences. If a large oil spill occurs in or reaches the marine environment during high-use periods for eiders, mortality of eiders is possible; any substantial loss of eiders could represent an important obstacle to full population recovery. Any tanker spill in the Gulf of Alaska could cause losses of wintering Steller s eiders that use ACP habitats during the breeding season.				

Summary and Comparison of Effects on the Economy				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
Impacts would be negligible; seismic surveys would furnish about 50 part-time jobs every other year and commercial recreation	**Effects of First Sale**: Alternative A, at $30/bbl of oil, would generate a 27% increase in North Slope Borough (NSB) revenue in the early years, tapering to a 5% increase in the	**Effects of First Sale**: The economic effects of oil and gas activities resulting from the first sale under Alternative B would be 10% less than Alternative A.	**Effects of First Sale**: Except for revenue for the federal and state governments received as a result of the lease sale, the economic effects of the first sale under Alternative C are likely to be the	**Effects of First Sale**: The Preferred Alternative, at $30/bbl, would generate a 24 % increase in NSB revenue in the early years, tapering to a 5 % increase in the later years. In the early years, oil

Summary and Comparison of Effects on the Economy (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
would furnish 1 part-time job annually.	later years. In the early years, oil production would generate increases in revenues to the State of Alaska of 3.4%; this would taper to <0.3% in the later years. The increase in total employment and personal income during exploration, development, and production would be <1% over the 1999 baseline for the NSB, South Central Alaska, and Fairbanks, except for NSB personal income during development, which would be 3.4%. Alternative A, at $18/bbl of oil, would generate a 1-year, 10% NSB revenue increase and <0.1% increase in employment and personal income for the NSB, South Central Alaska, and Fairbanks for 6 years of exploration.		same as those under the No Action Alternative because it is doubtful that development would occur.	production would generate increases in revenues to the State of Alaska of 3.1 %; this would taper to <0.3% in the later years. The increase in total employment and personal income during exploration, development, and production would be <1% over the 1999 baseline for the NSB, South Central Alaska, and Fairbanks, except for NSB personal income during development, which would be 3.1%. The Preferred Alternative, at $18/bbl would generate a 1-year, 9 %t NSB revenue increase and <0.1% increase in employment and personal income for the NSB, South Central Alaska, and Fairbanks.
	Effects of Multiple Sales: The economic effect of multiple sales is projected to be approximately twice that of the first sale.	**Effects of Multiple Sales**: The economic effects of multiple sales under Alternative B would be 10% less than for multiple sales under Alternative A.	**Effects of Multiple Sales**: Except for revenues obtained from any second or subsequent sale, the economic effects of multiple sales are likely to be the same as those for the single sale.	**Effects of Multiple Sales**: The effect of multiple sales for the Preferred Alternative is projected to be approximately twice that of the first sale.
Cumulative Effects: The onshore and offshore oil industry in and near Prudhoe Bay is expected to decline. This decline would reduce direct employment and associated indirect employment in South Central Alaska, Fairbanks, and the NSB, and revenues to the Federal, State, and NSB governments. Variation in cumulative impacts among alternatives would be limited to the differences in impacts directly attributable to the alternatives.				

Summary and Comparison of Effects on Cultural Resources

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts would include displacement and/or destruction of resources and are anticipated to be minimal whether or not seismic activity is allowed.	**Effects of First Sale**: Impacts, though potentially higher than for the No Action Alternative, would still be minimal.	**Effects of First Sale**: Impacts would be slightly reduced from those under Alternative A primarily because of increased environmental constraints.	**Effects of First Sale**: Impacts would be significantly reduced from those under Alternative A because of increased environmental constraints, including a substantial reduction in the area made available to leasing.	**Effects of First Sale**: Impacts from activities other than oil and gas exploration and development would be the same as the No Action Alternative. Impacts would include displacement and/or destruction of resources and are anticipated to be minimal regardless of the level of seismic activity. Under the Preferred Alternative, overall potential impacts to cultural resources would probably be minor because of the environmental constraints that would be in effect. These constraints would benefit cultural resources because of the high probability of cultural resources being located near lakes, streams and rivers, which are afforded more protection from oil and gas exploration under Stipulations K-1 and K-2.
	Effects of Multiple Sales: Impacts could be twice those of the first sale.	**Effects of Multiple Sales**: Impacts should be slightly less than those for Alternative A.	**Effects of Multiple Sales**: Impacts may be slightly greater than that for a single sale.	**Effects of Multiple Sales**: Impacts from management activities other than oil and gas exploration and development would be the same as the No Action Alternative. Overall, impacts would increase somewhat simply because multiple sales would increase the amount of land that could potentially be impacted.
Cumulative Effects: With current procedures for survey and inventory prior to oil and gas exploration and development activities, the impact to the resource would be minimal.				

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Summary and Comparison of Effects on Subsistence-Harvest Patterns

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Subsistence resources of the communities of Pt. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut could be affected periodically, but overall effects on subsistence-harvest activities would be negligible.	**Effects of First Sale**: Subsistence-harvest patterns effects are expected to be minor with subsistence resources being periodically affected but no resource becoming unavailable, undesirable for use, or experiencing overall population reductions. Moderate to high effects, however, could occur if development takes place in critical insect relief areas, because caribou could become unavailable, undesirable for use, or experience reduced availability for a period greater than 2 years.	**Effects of First Sale**: Subsistence-harvest patterns effects are expected to be the same or somewhat less that Alternative A.	**Effects of First Sale**: Subsistence-harvest patterns effects are expected to minor, with subsistence resources being periodically affected but no resource becoming unavailable, undesirable for use, or experiencing overall population reductions. No development is anticipated, but even if some do occur impacts would not rise above minor because many critical habitats and harvest areas are unavailable for leasing.	**Effects of First Sale**: Effects would be the same or slightly reduced from Alternative A. Effects are expected to be minor with subsistence resources experiencing local, short-term impacts and no resource becoming unavailable, undesirable for use, or experiencing overall population reductions. Moderate to high effects could occur if development takes place in critical insect-relief areas, if caribou become unavailable, undesirable for use, or experience reduced availability for a period greater than 2 years.
	Effects of Multiple Sales: Despite increased impacts on subsistence resources, effects to subsistence harvest practices in the communities of Pt. Lay, Wainwright, Atqasuk, Barrow, and Nuiqsut would still be expected to be minor, or possibly higher if development occurs in the TLH insect relief area	**Effects of Multiple Sales**: Effects to subsistence harvest practices in the communities of Pt. Lay, Wainwright, Atqasuk, Barrow, and Nuiqsut would still be expected to be minor, or possibly higher if development occurs in the TLH insect relief area	**Effects of Multiple Sales**: Effects to subsistence harvest practices in the communities of Pt. Lay, Wainwright, Atqasuk, Barrow, and Nuiqsut would still be expected to be minor	**Effects of Multiple Sales**: Most resources would see increases in effects due to increases in development activity. Overall effects on subsistence resources are expected to be local and short term (generally < 1 year), and to have no regional population effects. Effects to subsistence harvest practices in the communities of Point. Lay, Wainwright, Atqasuk, Barrow, and Nuiqsut would be expected to be minor, but if caribou experienced population effects, effects on community subsistence-harvest patterns would increase to high or very high effects if caribou become unavailable, undesirable for use, or experience reduced availability for

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Summary and Comparison of Effects on Subsistence-Harvest Patterns (continued)				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
				a period up to 5 years or longer. Under the Preferred Alternative, terrestrial subsistence harvest areas for the communities of Pt. Lay and Wainwright would be included in a large deferral area where leasing would be deferred for 10 years, which would reduce potential impacts on subsistence practices in the areas used by Pt. Lay and Wainwright hunters
Cumulative Effects: Caribou could become unavailable, undesirable for use, or experience long-term population and productivity effects for a period longer than 5 years a significant adverse effect. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources could change, if oil development reduces the availability of resources or alters their distribution patterns. The communities of Pt. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut would be most affected. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive (but not synergistic) significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.				

Summary and Comparison of Effects on Sociocultural Systems				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
Changes in the sociocultural systems of the communities of Pt. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut are expected to be negligible.	**Effects of First Sale**: Periodic impacts on subsistence activities could periodically disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources.	**Effects of First Sale**: Effects would be the same or slightly reduced from Alternative A.	**Effects of First Sale**: Effects would likely be less than those under Alternative A because the risk of periodic impacts on subsistence from impacts on caribou in the insect relief area and from oil spills will be greatly reduced.	**Effects of First Sale**: Effects would be the same or slightly reduced from Alternative A. Effects on the sociocultural systems of the communities of Pt. Lay, Wainwright, Atqasuk, Barrow, and Nuiqsut would come from local and short-term, subsistence effects that could periodically disrupt, but not displace, ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources.

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Summary and Comparison of Effects on Sociocultural Systems (continued)				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Effects of Multiple Sales: Although traditional practices for the harvesting, sharing, and processing of subsistence resources could be disrupted this would not be expected to displace existing institutions or ongoing social systems.	**Effects of Multiple Sales**: Effects would be the same or slightly reduced from those of multiple sales under Alternative A.	**Effects of Multiple Sales**: The risk of impacts will not be greatly increased over that for the first sale.	**Effects of Multiple Sales**: Effects could cause chronic disruption of sociocultural systems for a number of years. Traditional practices for the harvesting, sharing, and processing of subsistence resources could be disrupted, subsistence impacts would not be expected to displace existing institutions or ongoing social systems. Deferral of leasing for 10 years for estuarine areas along the western coast of the Planning Area and important terrestrial subsistence harvest areas for the communities of Wainwright and Pt. Lay would further reduce sociocultural effects in these two communities by reducing potential effects to subsistence resources and practices.
Cumulative Effects: Cumulative effects, primarily those related to residents reliance on caribou for subsistence, could chronically disrupt sociocultural systems in the community for a period longer than 5 years-a significant effect. Effects would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but are not expected to displace sociocultural institutions, social organization, or sociocultural systems.				

Summary and Comparison of Effects on Environmental Justice				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
Disproportionate, high adverse effects are not expected.	**Effects of First Sale**: Disproportionate, high adverse effects may be experienced by Pt. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut because of potential impacts on TLH caribou.	**Effects of First Sale**: Disproportionate, high adverse effects may be experienced by Pt. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut because of potential impacts on TLH caribou.	**Effects of First Sale**: Disproportionate, high adverse effects are not expected.	**Effects of First Sale**: Potential environmental justice related impacts would occur from long-term population and productivity effects to TLH caribou if development occurred in critical insect relief areas.

Summary and Comparison of Effects on Environmental Justice (continued)

				Disproportionate, high adverse effects would be experienced by Point. Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut--communities that harvest caribou from the TLH. Deferral of leasing for 10 years for estuarine areas along the western coast of the Planning Area and important terrestrial subsistence harvest areas for the communities of Wainwright and Pt. Lay would further reduce sociocultural effects in these two communities by reducing potential effects to subsistence resources and practices. ROP H-1 provides for local stakeholder participation in planning and decision-making to prevent unreasonable conflicts between subsistence uses and oil and gas activities and ROP H-2 is designed to prevent unreasonable conflicts between subsistence activities and seismic surveying; both would both serve to further reduce environmental justice impacts.
	Effects of Multiple Sales: The effects of multiple sales would be essentially the same as those above for the first sale.	**Effects of Multiple Sales**: The effects of multiple sales would be essentially the same as those above for the first sale.	**Effects of Multiple Sales**: The effects of multiple sales would be essentially the same as those above for the first sale.	**Effects of Multiple Sales**: The only substantial source of potential environmental justice related effects to the Native villages would occur from long-term population and productivity effects to the TLH caribou development, if any, in critical insect relief. Disproportionate, high adverse effects would be experienced by

Summary and Comparison of Effects on Environmental Justice (continued)				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
				Point Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut–communities which all harvest caribou from the Teshekpuk Lake Herd. Deferral of leasing for 10 years for estuarine areas along the western coast of the Planning Area and important terrestrial subsistence harvest areas for the communities of Wainwright and Pt. Lay would further reduce sociocultural effects in these two and practices. ROP H-1 provides opportunities for local stakeholder participation in planning and decision-making to prevent unreasonable conflicts between subsistence uses and oil and gas activities and ROP H-2 is designed to prevent unreasonable conflicts between subsistence activities and seismic surveying; both serve to further reduce subsistence conflicts and any consequent sociocultural and environmental justice impacts.
Cumulative Effects: Disproportionate, high adverse effects are expected.				

Summary and Comparison of Effects on Coastal Zone Management				
No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Preferred Alternative**
No conflicts with the Alaska Coastal Management Program (ACMP) standards or the enforceable policies of the NSB Coastal Management	**Effects of First Sale**: No conflicts with the ACMP standards or the enforceable policies of the NSB Coastal Management Program are anticipated.	**Effects of First Sale**: No conflicts with the ACMP standards or the enforceable policies of the NSB Coastal Management Program are anticipated.	**Effects of First Sale**: No conflicts with the ACMP standards or the enforceable policies of the NSB Coastal Management Program are anticipated.	**Effects of First Sale**: There are no inherent conflicts between exploration and development activities envisioned under the Preferred Alternative and the statewide standards and enforceable policies of the NSB

Summary and Comparison of Effects on Coastal Zone Management (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Program are anticipated.				CMP. With mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies relevant to oil and gas activities that have reasonably foreseeable effects on the coastal resources or uses of the coastal zone. Applicable policies can be more precisely addressed when specific proposals are brought forward by lessees.
	Effects of Multiple Sales: No conflicts are anticipated.	**Effects of Multiple Sales**: No conflicts are anticipated.	**Effects of Multiple Sales**: No conflicts are anticipated.	**Effects of Multiple Sales**: No conflicts are anticipated with the statewide standards of the ACMP and the enforceable policies of the NSB CMP.
Cumulative Effects: Conflicts with Statewide standards of the ACMP and the policies of the NSB are not inherent in the scenarios assumed for this EIS.				

Summary and Comparison of Effects on Recreational Resources and Wilderness

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts would be minimal and short term, except that seismic activities may create green trails, which may persist 2 to 5 years.	**Effects of First Sale**: Impacts from non-oil and gas activities would be minimal and short term. Green trails and green pads may occur where seismic surveys and exploratory drilling activities occur and persist for 2 to 5 years. Oil and gas development would result in a long-term loss of scenic quality, solitude, naturalness, and/or primitive/unconfined recreation of up to 2.4% of the Planning Area for the life of production fields and pipelines.	**Effects of First Sale**: Impacts would be similar to those for Alternative A, except that the amount of green trails would be reduced in proportion to decreases in seismic and exploratory drilling operations and impacts from development would result in the long-term loss on up to 2.0% of the Planning Area for the life of production fields and pipelines.	**Effects of First Sale**: Impacts would be similar to those for Alternative A, except that the amount of green trails would be reduced in proportion to decreases in seismic and exploratory drilling operations. Development would not occur, or if it did occur, impacts would be less than Alternatives A or B.	**Effects of First Sale**: Short-term impacts from non-oil and gas activities would increase, adversely affecting approximately 2,000 acres. Short-term impacts from oil and gas activities would impact 56,000 acres (at $18/bbl of oil) and 240,000 acres (at $30/bbl of oil). Oil and gas development would result in a long-term loss of solitude, naturalness, and/or primitive/unconfined recreation over very few acres with oil at $18/bbl; however, with oil at $30/bbl, the long-term loss would be an area of approximately 203,200 acres, or 2.2% of the

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Summary and Comparison of Effects on Recreational Resources and Wilderness (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				Planning Area for the life of production fields and pipelines.
	Effects of Multiple Sales: Long-term impacts from development may increase to affect up to about 3.7% of the Planning Area.	**Effects of Multiple Sales**: Long-term impacts from development may increase to affect up to about 3.4% of the Planning Area.	**Effects of Multiple Sales**: Long-term impacts would not be appreciably greater than those of the first sale.	**Effects of Multiple Sales**: Long-term impacts would be about the same as those of the first sale. Long-term impacts may increase to affect approximately 273,600 acres, or about 3.4% of the Planning Area. Restricting activities such as exploratory oil and gas operations and overland moves to winter months would considerably reduce impacts to recreation values.
Cumulative Effects: Opportunities for primitive recreation have and wi'l continue to be reduced by oil and gas activities on the North Slope. Facilities at Deadhorse support recreational opportunities along the Dalton Highway and at Prudhoe Bay.				

Summary and Comparison of Effects on Wild and Scenic Rivers

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts on WSR values are expected to be minimal.	**Effects of First Sale**: Impacts on WSR values would be limited in scope	**Effects of First Sale**: Impacts are expected to be less than under Alternative A because of additional restrictions that protect stream banks and limit potential withdrawals of water.	**Effects of First Sale**: Impacts are expected to be less than under any of the other alternatives because of additional restrictions that protect stream banks and limit potential withdrawals of water.	**Effects of First Sale**: Impacts on WSR values would be limited. They are expected to be minimized by the deferral area, protected coastal areas, river buffers, and stipulations and ROP's that protect stream banks and limit potential withdrawals of water. The Colville River would likely see the greatest negative impact to river values because it is not under BLM management and would likely be crossed by access trails, ice roads, and pipelines. The Avak, Tunalik, Nokotlek, and Ongoravik rivers in the Kasegaluk Lagoon area are currently not impacted by oil and gas activities, and this situation is

Summary and Comparison of Effects on Wild and Scenic Rivers (continued)

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
				likely to continue because of low potential development.
	Effects of Multiple Sales: Multiple sales would have little additional impact on river values.	**Effects of Multiple Sales**: Multiple sales would have little additional impact on river values.	**Effects of Multiple Sales**: Multiple sales would have little additional impact on river values.	**Effects of Multiple Sales**: Multiple sales would have little additional impact on river values.
Cumulative Effects: Impacts to the WSR values of Planning Area rivers is limited to those described for the respective alternatives, plus the potential for impacts to portions of the Colville River under non-federal ownership. The only Wild and Scenic River north of the Brooks Range is the portion of the Ivashak River within the Arctic National Wildlife Refuge; its values are adequately protected.				

Summary and Comparison of Effects on Visual Resources

No Action	Alternative A	Alternative B	Alternative C	Preferred Alternative
Impacts from activities other than oil and gas would be minimal and short-term, affecting about 500 acres. Impacts from seismic surveys would be short-term, affecting approximately 500 acres every other winter. Several hundred miles of green trails from overland moves and seismic surveys would be visible during summer months for 2 to 5 years.	**Effects of First Sale**: Impacts from activities other than oil and gas would be similar to those for the No Action Alternative. Impacts from seismic would increase substantially resulting in short-term impacts affecting up to 1,500 acres every winter and possibly 6 times the vegetative greening. Short-term impacts from exploratory drilling would impact approximately 16,000 acres and greening could occur on less than 2,000 acres of exploratory drilling facilities. Oil and gas development would result in the long-term loss of visual resources of approximately 2.3% of the Planning Area for the life of the production fields and pipelines.	**Effects of First Sale**: Impacts would be reduced from those of Alternative A; impacts from seismic by about a third, impacts from exploratory drilling by a quarter, and impacts from development by about an eighth.	**Effects of First Sale**: Impacts from non-oil and gas and seismic activities will be similar to those of the No Action Alternative. Impacts from exploratory drilling would be reduced by a quarter. Oil and gas development are not expected to take place under this Alternative.	**Effects of First Sale**: Impacts from activities other than oil and gas would be similar to those for the No Action Alternative. Short-term impacts from ongoing seismic activities would impact approximately 1,000 acres. The greening and ring effect of vegetation resulting from ice pads, roads, airstrips and compacted snow would impact up to 1,500 acres. Short-term impacts from exploratory drilling would encompass approximately 12,000 acres. Oil and gas development would result in the long-term loss of visual resources of approximately 166,700 acres, or 2% of the Planning Area, for the life of production fields and pipelines.

Summary and Comparison of Effects on Visual Resources (continued)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Effects of Multiple Sales: Short-term impacts would not accumulate. Long-term or permanent facilities would impact about 6.6% of the Planning Area.	**Effects of Multiple Sales**: Short-term impacts would not accumulate. Long-term or permanent facilities would impact about 6% of the Planning Area.	**Effects of Multiple Sales**: There would be no additional impacts from multiple sales.	**Effects of Multiple Sales**: Short-term impacts such as green trails and pads, and other ongoing activities would not accumulate. Long-term Impacts from permanent facilities such as roads, pipelines, gravel pads, and pits would accumulate to the extent necessary to support exploration and production activities. These facilities would impact about 6% of the Planning Area, or approximately 505,500 acres.
Cumulative Effects: Oil and gas activities both east and west of Prudhoe Bay have impacted and will continue to impact visual resources of the North Slope. Impacts range from vegetative greening caused by seismic surveying and exploratory drilling to long-term presence of production pads, support facilities, roads, and pipelines.				

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APPENDIX 3. VISUAL RESOURCE MANAGEMENT

A. DEFINITION

Visual Resource Management (VRM) classes are used to define minimum management objectives. Each class describes the degree of modification allowed in the basic elements of the characteristic landscape under various circumstances. The objective is to retain the character of the landscape as much as possible.

The VRM classes are defined in terms of three factors: 1) scenic quality, 2) visual sensitivity, and 3) distance zones. The classes are then used as the basis for the following objectives: 1) enhancement, 2) rehabilitation, and 3) protection. Finally, these objectives outline the VRM program for resource planning and project design.

B. RESOURCE MANAGEMENT CLASSES

Class I

This class encompasses mostly natural ecological changes but does not preclude very limited management activity. Any contrast created within the characteristic landscape must not attract attention. This class applies to wilderness areas, wild and scenic rivers, and other, similar situations.

Class II

Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. The contrast may be seen but must not attract attention.

Class III

Contrasts to the basic elements (form, line, color, texture) caused by a management activity may be evident and may even begin to attract attention but should remain subordinate to the existing landscape.

Class IV

Contrast may attract attention and be a dominant feature of the landscape in terms of scale but should repeat the form, line, color, and texture of the characteristic landscape.

Class V

Change is needed or change may add acceptable visual variety to an area. This class applies to areas in which the natural character has been disturbed to the point where rehabilitation is needed to bring it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation in which it has been necessary to apply the lowest quality classification because of unacceptable cultural modification.

C. DESIGN TECHNIQUES FOR MITIGATING VISUAL IMPACT

1. Landform/Waterbody

a. Reduce the size of cut and fill slopes. Consider:

1. relocating to an area with less slope;
2. changing road width, grade, etc;
3. changing alignment to follow existing grades; and
4. prohibiting dumping of excess material on downhill slopes.

b. Reduce earthwork contrasts. Consider:

1. rounding and/or warping slopes;
2. retaining rocks, trees, drainages, etc.;
3. toning down freshly broken rock faces with asphalt-emulsion spray or with gray paint;
4. adding mulch, hydro mulch, or topsoil;
5. shaping cuts and fills to appear as natural forms;
6. cutting rock areas so forms are irregular;
7. designing to take advantage of natural screens (i.e., vegetation, landforms); and
8. grass seeding of cuts and fills.

c. Maintain the integrity of topographic units. Consider:

1. locating projects away from prominent topographic features; and
2. designing projects to blend with topographic forms in shape and placement.

2. Vegetation

a. Retain existing vegetation. Consider:

1. using retaining walls on fill slopes;
2. reducing surface disturbance; and
3. protecting roots from damage during excavations.

b. Enhance revegetation. Consider:

1. mulching cleared areas;
2. controlling planting times;
3. furrowing slopes;
4. digging holes for plants on cut/fill slopes;
5. choosing native plant species;
6. stockpiling and reusing topsoil; and
7. fertilizing, mulching, and watering vegetation.

c. Minimize impact on existing vegetation. Consider:

1. partial cutting instead of clear cutting;
2. using irregular clearing shapes;
3. feathering/thinning edges;
4. disposing of all slash;
5. controlling construction access;
6. utilizing existing roads;
7. limiting work within construction area;
8. selecting type of equipment to be used;
9. minimizing clearing size (i.e., strip only where necessary); and
10. seeding cleared areas with grass.

d. Maintain the integrity of vegetative units. Consider:

1. utilizing the edge effect for structure placement along natural vegetative breaks.

3. Structures

a. Minimize the number of visual structures.

b. Minimize structure contrast. Consider:

1. using earth tone paints and stains;
2. using cor-ten steel (self-weathering);
3. treating wood for self-weathering;
4. using natural stone surfaces;
5. burying all or part of the structure; and
6. selecting paint finishes with low levels of reflectivity (i.e., flat or semigloss).

c. Redesign structures that do not blend/fit in. Consider:

1. using rustic designs and native building materials;
2. using natural-appearing forms to complement landscape character (use special designs only as a last resort); and
3. relocating structure.

d. Minimize the impact of utility crossings. Consider:

1. making crossings at right angles;
2. setting back structures at a maximum distance from the crossing;
3. leaving vegetation along the roadside;
4. minimizing view time;
5. utilizing natural screening; and
6. relocating structure

e. Recognize the value and limitations of color. Consider:

1. that color (hue) is most effective within 1,000 feet. Beyond that point, color becomes more difficult to distinguish and tone or value determines visibility and resulting visual contrast;
2. that color has limited effectiveness in structures that are silhouetted against the sky;
3. that painting structures somewhat darker than the adjacent landscape compensates for the effects of shade and shadow; and
4. selecting color to blend with the land instead of the sky.

APPENDIX 4. INFORMATION TO LESSEES

The following table summarizes many permit and other requirements that must be met before oil and gas exploration or development activities may occur. Some obligations would be placed directly on the applicant. Others would be placed on Federal Agencies before they could grant authorizations for which oil and gas firms apply.

Federal, State, and North Slope Borough Permits And/or Approvals For Oil and Gas Exploration and Development/Production Activities

Regulatory Agency	Permit/Approval Actions/ Requirements
FEDERAL	
U.S. Army Corps of Engineers (Corps)	• Issues a Section 404 permit under the Federal Water Pollution Control Act of 1972, as amended (Clean Water Act) (33 USC 1344) for discharge of dredged and fill material into U.S. waters, including wetlands. • Issues a Section 10 permit under the Rivers and Harbors Act of 1899 (33 USC 403) for structures or work in, or affecting, navigable waters of the U.S. • Issues a Section 103 Ocean Dumping permit under Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 (33 USC 27) for transport of dredged material for ocean disposal.
U.S. Environmental Protection Agency (EPA)	• Issues a National Pollutant Discharge and Elimination System (NPDES) Permit and Fact Sheet under Section 402, Federal Water Pollution Control Act of 1972, as amended (Clean Water Act) (33 USC 1251) for discharges into the marine environment. • Issues an Underground Injection Control Class 1 Industrial Well permit under the Safe Drinking Water Act (40 CFR 124 A, 40 CFR 144, 40 CFR 145) for underground injection of Class I (industrial) waste materials. • Issues a Spill Prevention Containment and Countermeasure (SPCC) Plan under Section 311, Federal Water Pollution Control Act (Clean Water Act) as amended, (40 CFR 112) for storage of over 660 gallons of fuel in a single container or over 1,320 gallons in aggregate in tanks above ground. • Conducts a review and evaluation of the Draft and Final EIS for compliance with CEQ guidelines (40 CFR 1500-1508) and Section 309 of the Clean Air Act. • Authority delegated to DEC to issue air quality permits for facilities operating within state jurisdiction Title V operating permit and a Prevention of Significant Deterioration (PSD) permit under the Clean Air Act, as amended (42 USC 7401), to address air pollutant emissions.

National Marine Fisheries Service (NOAA Fisheries, formerly NMFS)	■ Provides consultation under the Endangered Species Act of 1973, Section 7(a)(2) regarding effects to threatened or endangered species. ■ Provides consultation under the Magnuson-Stevens Fishery Management and Conservation Act for effects on Essential Fish Habitat (EFH). ■ Provides consultation under Fish and Wildlife Coordination Act regarding effects on fish and wildlife resources. ■ Provides consultation under the Marine Mammal Protection Act regarding effects on marine mammals. ■ Issues Incidental Harassment Authorization under the Marine Mammal Protection Act for incidental takes of protected marine mammals (bowhead whales and ringed seals).
U.S. Department of the Interior, Bureau of Land Management (BLM)	■ Reviews and approves Applications for Permit to Drill (including drilling plans and surface-use plans of operations) and Subsequent Well Operations as prescribed in 43 CFR Part 3160,under authority of the Naval Petroleum Reserves Production Act (43 USC 6501-6508) and other Federal laws, for development and production of Federal leases. ■ Approves lease administration requirements including Unit Agreements and plans of development, Communitization Agreements, Participating Area Determinations, as described in 43 CFR 3130 and 3180, under the Mineral Leasing Act of 1920 (30 USC Sec. 181 et seq.), Federal Oil and Gas Royalty Management Act of 1982 (42 USC 4321 et seq.), Naval Petroleum Reserves Production Act of 1976 (42 USC 6504), and the Department of the Interior Appropriations Act, Fiscal Year 1981 (42 USC 6508), and other Federal laws, for exploration and development of oil and gas leases. ■ Issues geophysical permits to conduct seismic activities as described in 43 CFR 3150, under authority of the Mineral Leasing Act of 1920 (30 USC Sec. 181 et seq.), Alaska National Interest Lands Conservation Act (16 USC 1301 et seq.), Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.), Naval Petroleum Reserves Production Act of 1976 (42 USC 6504), and the Department of the Interior Appropriations Act, Fiscal Year 1981 (42 USC 6508). ■ Issues right-of-way grants and temporary use permits for the construction, operation, and maintenance of pipeline, production, and related facilities under the Naval Petroleum Reserves Production Act (42 USC 6501-6508). ■ Delegates authority to DEC for review and approval of Oil Discharge Prevention and Contingency Plans (ODPCP) and Certification of Financial Responsibility (COFR) for accidental oil discharge into navigable waters under Section 4202(b)(4) of the Oil Pollution Act of 1990 (OPA90); Sec. 311(j)(5) of the Federal Water Pollution Control Act; 30 CFR 254.
U.S. Fish and Wildlife Service (FWS)	■ Provides consultation under the Endangered Species Act of 1973, Section 7(a)(2) regarding effects to threatened or endangered species. ■ Provides consultation under the Fish and Wildlife Coordination Act regarding effects to fish and wildlife resources. ■ Issues a Letter of Authorization under the Marine Mammal Protection Act for incidental takes of marine mammals.

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STATE	
Alaska Department of Environmental Conservation (ADEC)	■ Issues a Certificate of Reasonable Assurance for discharge of dredged and fill material into U.S. waters under Section 401, Federal Water Pollution Control Act of 1972, as amended in 1977 (Clean Water Act) (33 USC 1341); AS 46.03.020; 18 AAC 15; 18 AAC 70; and 18 AAC 72. ■ Issues a Certificate of Reasonable Assurance/NPDES and Mixing Zone Approval for wastewater disposal into all state waters under Section 402, Federal Water Pollution Control Act of 1972, as amended (Clean Water Act) (33 USC 1341 et seq.); AS 46.03.020, .100, .110, .120, & .710; 18 AAC 15, 70, 010 & 72.500. ■ Issues a Class I well wastewater disposal permit for underground injection of non-domestic wastewater under AS 46.03.020,050, and 100. ■ Reviews and approves all public water systems including plan review, monitoring program, and operator certification under AS 46.03.020, 050, 070, and 720, 18 AAC 80.005. ■ Approves domestic wastewater collection, treatment, and disposal plans for domestic wastewaters (18 AAC 72). ■ Approval of financial responsibility for cleanup of oil spills (18 AAC 75). ■ Reviews and approves the Oil Discharge Prevention and Contingency Plan (ODPCP) and the Certificate of Financial Responsibility (COFR) for storage or transport of oil under AS 46.04.030, 18 AAC 75 et seq. The State review applies to oil exploration and production facilities, crude oil pipelines, oil terminals, tank vessels and barges, and certain non-tank vessels. ■ Issues a Title V Operating Permit and a Prevention of Significant Deterioration (PSD) permit under Clean Air Act Amendments (Title V) for air pollutant emissions from construction and operation activities(18 AAC 50). ■ Issues solid waste disposal permit for disposal of solid waste on State lands under AS 46.03.010, 020, 100, and 110; AS 46.06.080; 18 AAC 60.005 and 200. ■ Reviews and approves solid waste processing and temporary storage facilities plan for handling and temporary storage of solid waste on Federal and State lands under AS 46.03.005, 010, and 020, 18 AAC 60.430. ■ Approval of siting of hazardous waste management facilities.
Alaska Oil and Gas Conservation Commission (AOGCC)	■ Permit to Drill (20 AAC 25.005) ■ Annular Disposal of Drilling Waste (20 AAC 25.080) ■ Plugging, Abandonment, and Location Clearance (20 AAC 25.105 through 25.172) ■ Production Practices (20 AAC 25.200 through 25.245) ■ Class II Waste Disposal and Storage (20 AAC 25.252) ■ Workover Operations (20 AAC 25.280) ■ Reports (20 AAC 25.300 through 25.320) ■ Enhanced Recovery (20 AAC 25.402 through 25.460)
Office of the Governor/Division of Governmental Coordination (DGC)	■ Conducts a Coastal Zone Consistency review and issues determination of consistency of proposed development within the coastal zone under Coastal Zone Management Act of 1972, as amended in 1976 (16 USC 1451 et seq.); AS 46.40 Alaska Coastal Management Program Act of 1977; 6 AAC 50.

Alaska Department of Natural Resources (DNR)	■ Issues a Material Sales Contract for mining and purchase of gravel from State lands under AS 38.05.850; 11 AAC 71.070 through .075. ■ Issues Right-of-Way (ROW) and Land Use permits for use of State land, ice road construction on State land, and State freshwater bodies under AS 38.05.850. ■ Issues a Temporary Water Use and Water Rights permit under AS 46.15 for water use necessary for construction and operations. ■ Issues pipeline ROW leases for pipeline construction and operation across State lands under AS 38.35.020. ■ Issues a Cultural Resources Concurrence for developments that may affect historic or archaeological sites under the National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.); AS 41.35.010 to .240, Alaska Historic Preservation Act.
BOROUGH	
North Slope Borough (NSB)	■ Issues a Coastal Zone Consistency Determination to address project planning or development within the coastal zone under the Coastal Zone Management Act of 1972, as amended in 1976 (16 USC 1451) (AS 46.40 Alaska Coastal Management Program, 1977; Borough Ordinance 90-39 [6/19/90]).

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APPENDIX 5: ANILCA SECTION 810 ANALYSIS OF SUBSISTENCE IMPACTS

Sections III, IV, and V of this Northwest National Petroleum Reserve-Alaska (NPR-A) Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) provide a detailed description of both the affected environment of the Northwest NPR-A Planning Area and the potential adverse effects to subsistence of the various alternatives. This appendix uses the detailed information presented in the IAP/EIS to evaluate the potential impacts to subsistence pursuant to Section 810(a) of the Alaska National Interest Land Conservation Act (ANILCA).

I. SUBSISTENCE EVALUATION FACTORS

Section 810(a) of ANILCA requires that an evaluation of subsistence uses and needs be completed for any Federal determination to "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." As such, an evaluation of potential impacts to subsistence under ANILCA § 810 must be completed for the Northwest NPR-A IAP/EIS. ANILCA requires that this evaluation include findings on three specific issues:

1. the effect of such use, occupancy, or disposition on subsistence uses and needs;
2. the availability of other lands for the purpose sought to be achieved; and
3. other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 U.S.C. § 3120).

The evaluation and findings required by ANILCA § 810 are set out for each of the five alternatives (including the No Action Alternative) considered in this IAP/EIS.

A finding that the proposed action may significantly restrict subsistence uses imposes additional requirements, including provisions for notices to the State and appropriate regional and local subsistence committees, a hearing in the vicinity of the area involved, and the making of certain determinations as required by Section 810(a)(3). The determinations required are that:

1. such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the utilization of the public lands;
2. the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition; and
3. reasonable steps will be taken to minimize adverse effects upon subsistence uses and resources resulting from such actions.

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To determine if a significant restriction of subsistence uses and needs may result from any one of the alternatives discussed in this IAP/EIS, including their cumulative effects, the following three factors in particular are considered: 1) the reduction in the availability of subsistence resources caused by a decline in the population or amount of harvestable resources; 2) reductions in the availability of resources used for subsistence purposes caused by alteration of their normal locations and distribution patterns; and 3) limitations on access to subsistence resources, including from increased competition for the resources.

A significant restriction to subsistence may occur in at least two instances: 1) when an action substantially may reduce populations or their availability to subsistence users, and 2) when an action may substantially limit access by subsistence users to resources. The Environmental Consequences section of this IAP/EIS provides much of the data concerning levels of reductions and limitations, and was used to determine whether the level of effects of each alternative is extensive enough to cause a possible significant restriction to subsistence. Information regarding areas and resources important for subsistence use and the degree of dependence of affected villages on different subsistence populations is provided in Section III, Affected Environment. The information contained in this IAP/EIS is the primary data used in this analysis.

A subsistence evaluation and findings under ANILCA § 810 must also include a cumulative impacts analysis. Section II below (Appendix 5.B) begins with an evaluation and finding for the Preferred Alternative. Separate evaluations and findings follow for each of the five alternatives in the IAP/EIS, as well as a finding that includes the posited cumulative impacts. Finally, the most intensive cumulative case--as is discussed in Section IV.F of this IAP/EIS--is evaluated. This approach helps the reader to separate the subsistence restrictions that may be caused by activities proposed by the IAP/EIS alternatives from those that may be caused by past, present, and future activities that may occur, or have already occurred, in the surrounding area.

In addition to ANILCA, Environmental Justice as defined in Executive Order 12898 also calls for the analysis of Federal actions on minority populations with regard to subsistence. Specifically, Environmental Justice is:

"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."

Section 4-4 of Executive Order 12898 regarding the Subsistence Consumption of Fish and Wildlife requires Federal Agencies to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence, and to communicate to the public any risks associated with the consumption patterns. To this end, the subsistence analyses of all alternatives located in Sections IV and V of the IAP/EIS have been reviewed, and are found to comply with Environmental Justice.

II. ANILCA 810(A) EVALUATIONS AND FINDINGS FOR THE ALL ALTERNATIVES AND THE CUMULATIVE CASE

The following evaluations are based on information relating to the environmental and subsistence consequences of the single-sale and multiple-sales scenarios for the Preferred Alternative, No Action Alternative, Alternatives A through C, and the cumulative case as presented in Sections IV and V of this IAP/EIS. The stipulations discussed in Section II.C.6 of the IAP/EIS are also considered for the alternatives to which they apply. The evaluations and findings focus on potential impacts to the subsistence resources themselves, as well as access, economic, and cultural issues that relate to subsistence use.

A. Evaluation and Findings for the Preferred Alternative

The Preferred Alternative, as well as the stipulations and required operating procedures accompanying it, was created by taking into consideration all comments and concerns generated by the Draft IAP/EIS. Specifically, subsistence hearings held in the communities of Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, Point Lay, and Wainwright contributed greatly to this alternative. The Preferred Alternative of the IAP/EIS makes all lands within the Planning Area available for oil and gas leasing. However, leasing would be deferred for ten years on 1.57-million acres of land located in the western portion of the Planning Area near the village of Wainwright and encompassing Kasegaluk Lagoon and Peard Bay. This "Deferral Area" would be useful when conducting fish and wildlife studies as an example of populations not yet affected by oil and gas activities. The 11 stipulations and 30 ROP's defined in Section II.C.6 would be the primary protective measures used to manage activities under the Preferred Alternative in the Northwest NPR-A Planning Area.

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The analysis of the Preferred Alternative on subsistence presented in Section V.B.14 considers the effects of non-oil and gas activities, the effects of oil and gas activities, the effects of oil spills, and the effectiveness of the stipulations and ROP's required by the BLM. The analysis concludes that the effect of the Preferred Alternative would be negligible to subsistence species, access to subsistence resources, or to the communities of Point Lay, Anaktuvuk Pass, Wainwright, Nuiqsut, Atqasuk, or Barrow as long as development in critical insect-relief habitat of the Teshekpuk Lake Herd (TLH) caribou does not occur. If development in this area were to occur, then the villages of Atqasuk, Barrow, and especially Nuiqsut would experience moderate or high effects to this important subsistence resource.

Similarly, analyses presented for individual subsistence species (i.e., marine mammals, land mammals, migratory waterfowl, etc.) also find negligible impacts as a result of the various scenarios under the Preferred Alternative, with most impacts being temporary and insignificant at the population level (see Section V.B.8 , Section V.B.9 , and Section V.B.10). These findings are in large part due to the stipulations and ROP's, which serve to limit the effects of potential impacts to many resources.

Effects to subsistence resources by non-oil and -gas activities consist primarily of those actions associated with research. Numerous studies are conducted on a year-round basis on the North Slope, and aerial survey by fixed-wing or helicopter, or ground surveys on foot or by off-highway vehicle (OHV), all have the potential to disturb animals. The most frequent complaints voiced by local subsistence users is the large amount of aerial disturbance to animals that occurs each field season in conjunction with scientific studies (Subsistence Advisory Panel [SAP] Minutes, June 6, 2002 meeting; SAP Minutes, August 22, 2002 meeting). The objective of ROP F-1 is to minimize the effects of low-flying aircraft on wildlife, traditional subsistence activities, and local communities. To this end, it requires a series of minimum altitudes allowed to be flown during various seasons so as not to disturb caribou or raptors. ROP F-1(d) further states that "use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum."

Oil and gas activities that could occur under the Preferred Alternative include leasing, exploration, and development/production. Leasing, in and of itself, would not affect subsistence resources or uses in the NPR-A, as it does not require on-the-ground activity. Exploration activity allowed under the Preferred Alternative includes seismic studies, both 2-D and 3-D; the drilling of exploration and delineation wells; and the construction of ice roads, landing strips, and remote exploratory staging areas. Development is expected to be carried out given two factors: 1) if substantial reserves are located, and 2) if the price of oil per barrel makes oil production profitable. Development involves permanent oil and gas infrastructure and facilities such as pipelines, gravel roads, bridges, well pads, and airstrips.

All exploration activities that will occur in the Planning Area under the Preferred Alternative will take place in the winter, as specified in Stipulation C-1, which states that ground operations are to begin only after the frost depth and snow cover have reached sufficient depths to meet tundra protection objectives, and will cease when the spring melt of snow begins. Subsistence activities that occur during the winter, and therefore may be impacted by exploration operations, include furbearer trapping, fishing, and opportune hunting. Recent testimony by community members from Barrow and Nuiqsut has indicated that seismic exploration does interfere with overland travel by snow machine (SAP Minutes, June 6, 2002 meeting; Harry Brower, pers. comm.). Specifically, the deep ruts left in the snow by seismic vehicles create difficult terrain to traverse, and result in excessive wear and tear on both snow machines and the sleds that are pulled behind them. Replacement or repair of these tools that are used for subsistence harvesting is costly. However, despite the hindrance and annoyance, seismic exploration does not create a substantial barrier between communities and subsistence resources. ROP H-2 specifies the amount and types of consultation with local communities that must be carried out by applicants wanting to conduct seismic exploration.

Exploration operations (the drilling of exploratory wells) require the construction of ice roads and pads in order to move drill rigs and other heavy equipment to the remote drilling locations. Usually, only one exploratory well can be drilled per rig during a winter season, thus the number of exploratory wells drilled is dependent on the number of rigs in operation. Delineation wells are drilled around a positive exploration well (called the discovery well) to define the limits of a reservoir, and as many as 4 to 6 delineation wells can be drilled in a winter season on the exploratory ice pad or pads. Stipulation D-1 states that exploratory drilling is prohibited in rivers and streams--as determined by the active floodplain--and fish-bearing lakes, except where the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative. Ice roads constructed by the oil companies do not restrict movement of subsistence resources, and are frequently used by local residents for access to remote areas. Actual construction of the roads and ice pads could result in short-term displacement of furbearers or other small animals in the immediate area of construction, and water or ice withdrawal from lakes and streams could affect fish. However, Stipulation B-1 protects fish resources by limiting the amount of water withdrawal from any lake containing fish.

Under the Preferred Alternative, impacts as a result of development were analyzed using two sale scenarios: First Sale (meaning, what would be the result of just one lease sale) and Multiple Sales. Every analyst (Section V.B) found that impacts to resources would increase under the multiple-sale scenario, given the increase in both exploration and subsequent development. However, most analysts concluded that the impacts to resources would remain negligible, short term, and not relevant at the population level (meaning that there would be no significant reduction in population). At issue for subsistence are two primary development infrastructures: gravel roads and pipelines. Traffic on gravel roads has been shown to disrupt or delay caribou movement, and pipeline(s) could impede movement to important insect-relief areas, depending on where development occurs. Although roads connecting to a road system or docks outside of the Planning Area are considered unlikely, if such a road were built, then more people could access the area, resulting in an increase in competition for fish and game resources.

Under the Preferred Alternative, one pipeline from the oil field in the northern part of the Planning Area is expected to connect to the TAPS through facilities at the Kuparuk oil fields. The pipeline will be constructed during the winter, and no permanent road would be built adjacent to it. This pipeline corridor is located to the north of the community of Nuiqsut, through primary subsistence habitat. Experience has shown that while access for hunting and fishing is not restricted in development areas by law or policy, subsistence hunters are encouraged to stay away. Similarly, many hunters are wary to shoot or discharge firearms near pipelines or other development infrastructure. If a system to transport North Slope natural gas to southern markets was developed, a natural gas pipeline would be constructed from oil fields in the planning area to Prudhoe Bay. However, this pipeline would be buried, and would thus not affect access by subsistence hunters.

The three oil-spill scenarios considered in the IAP/EIS are: a small spill (3 barrels of unrefined, or 29 gallons of refined oil), a large spill (500 to 149,999 barrels of oil), and a very large spill (over 150,000 barrels). Of the three spill scenarios, the probability of a large or very large spill is low, and small spills are expected to be contained and cleaned up without causing notable impacts to resources. As a result, the effects of oil spills to subsistence resources or use are negligible, with only minor or short-term impacts anticipated.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in the NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in this EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. Other lands within the NPR-A that are managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. Lands outside of the NPR-A would not satisfy the Congressional directive to explore and develop oil and gas resources within the NPR-A. State and Native Corporation Lands cannot be considered in a BLM plan. This is why the Planning Area was selected for potential oil and gas leasing, exploration, and development at this time.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS. Many and varied mitigation measures to reduce the impacts on subsistence resources and uses have been taken into consideration, and these measures have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The effects of the Preferred Alternative fall below the level of significantly restricting subsistence use for all communities in or near the Planning Area (Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, Point Lay, and Wainwright). The Preferred Alternative creates special study areas for the important subsistence species of brant and caribou, and recommends the creation of the Kasegaluk Lagoon Special Area, consisting of 102,000 acres. Adequate stipulations and required operating procedures have been incorporated in the Preferred Alternative, including specific procedures for subsistence consultation with directly affected subsistence communities. It is for these reasons that the effects of the Preferred Alternative fall below the level of possibly significantly restricting subsistence uses and needs. The impacts to subsistence resources and access discussed above are minimal. This finding applies to all villages within the Planning Area.

B. Evaluation and Findings for the No Action Alternative

The No Action Alternative of the IAP/EIS precludes new management designations for land within the Northwest NPR-A. This means that the BLM would not impose any of the Federal land-use designations, many of which require specific prescriptions that limit the activities that can take place depending upon the designation and applicable laws or statutes. As such, certain landscapes or watersheds would not be selected as wilderness or as wild and scenic rivers, regardless of their scenic or biological resources. At the same time, no oil and gas leasing would be allowed; however, seismic exploration could occur under one option of the No Action Alternative in order to continue to identify and map the potential oil reserves within the Northwest NPR-A Planning Area.

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The analysis of the No Action Alternative on subsistence presented in Section IV.B.14 considers the effects of non-oil and gas activities, the effects of oil spills, the effects of seismic exploration (the only potential oil and gas activity under one option of this alternative), and the effectiveness of the stipulations and required operating procedures (ROP's) required by the BLM. The analysis concludes that the effect of the No Action Alternative would be negligible on subsistence species, access to subsistence resources, and to the communities of Point Lay, Wainwright, Nuiqsut, Atqasuk, or Barrow.

Effects to subsistence resources by non-oil and gas activities consist primarily of those actions associated with research. Numerous studies are conducted on a year-round basis on the North Slope, and aerial survey by fixed-wing aircraft or helicopter, or ground surveys on foot or by off-highway vehicle (OHV), all have the potential to disturb animals. The most frequent complaints voiced by local subsistence users is the large amount of aerial disturbance to animals that occurs each field season in conjunction with scientific studies (Subsistence Advisory Panel [SAP] Minutes, June 6, 2002 meeting; SAP Minutes, August 22, 2002 meeting). However, much of the scientific study that is currently occurring is a result of the required stipulations imposed on oil and gas activities in the Northeast NPR-A Planning Area. Because the No Action Alternative precludes oil and gas leasing, many of the current studies used to assess the effectiveness of stipulations on oil and gas operations would not occur in the Northwest NPR-A Planning Area. In addition, the mandatory stipulations and ROP's that would be imposed by the BLM for the Planning Area serve to minimize the potential effects of research by other entities. Based on the analysis presented in Section IV, the effects of non-oil and -gas activities on the species utilized by subsistence users is expected to be local and short-term, and to have no regional population effects.

The single oil- and gas-related activity allowed under one option of the No Action Alternative is seismic exploration, an activity that is assumed in this alternative to be limited to one operation per winter season. Subsistence activities that occur during the winter season--and therefore could be affected by seismic exploration--include: furbearer trapping, fishing, and opportune hunting. Recent testimony by community members from Barrow and Nuiqsut has indicated that seismic exploration does interfere with overland travel by snow machine (SAP Minutes, June 6, 2002 meeting; Harry Brower, personal communication). Specifically, the deep ruts left in the snow by seismic vehicles create difficult terrain to traverse, and result in excessive wear and tear on both snow machines and the sleds that are pulled behind them. Replacement or repair of these tools that are used for subsistence harvesting is costly. However, despite the hindrance and annoyance, seismic exploration does not create a substantial barrier between communities and subsistence resources. Additionally, under this alternative, only one seismic operation is expected per season, thus limiting the total area of snow cover to be impacted.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in this EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. The No Action Alternative does not authorize any new oil and gas exploration or development activities in the NPR-A. Other lands managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. State and Native Corporation Lands cannot be considered in a BLM plan.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Oil and gas exploration and development are not permitted under the No Action Alternative. Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS. Many and varied mitigation measures to reduce the impacts to subsistence resources and uses have been taken into consideration, and these measures have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The effects of the No Action Alternative fall below the level of possibly significantly restricting subsistence uses and needs. The impacts to subsistence resources and access discussed above are minimal. This finding applies to all villages within the Planning Area.

C. Evaluation and Findings for Alternative A

Alternative A of the IAP/EIS would make all land under the stewardship of the BLM within the Planning Area available for oil and gas leasing. However, additional oil- and gas-related activities, such as exploration, test drilling, or the placement of permanent facilities, would only be undertaken after subsequent NEPA analyses. The 10 stipulations and 21 required operating procedures (ROP's) defined in Section II.C.6 comprise the primary protective measures used to manage activities in the Northwest NPR-A Planning Area.

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The analysis of the effects of Alternative A on subsistence presented in Section IV.C.14 considers the effects of non-oil and gas activities, the effects of oil and gas activities, the effects of oil spills, and the effectiveness of the stipulations and ROP's required by the BLM. The analysis concludes that the effect of Alternative A would be negligible to subsistence species, access to subsistence resources, or to the communities of Point Lay, Wainwright, Nuiqsut, Atqasuk, or Barrow as long as development in critical insect-relief habitat of the Teshekpuk Lake Herd (TLH) caribou did not occur. If development in this area did occur, then the villages of Atqasuk, Barrow, and especially Nuiqsut would experience moderate or high effects to this important subsistence resource.

Similarly, analyses presented for individual subsistence species (i.e., marine mammals, land mammals, migratory waterfowl, etc.) also finds negligible impacts as a result of the various scenarios under Alternative A, with most impacts being temporary and insignificant at the population level (see Section IV.C. 8, 9, and 10). These findings are in part due to the stipulations and ROP's, which serve to limit the effects of potential impacts to many resources.

Non-oil and gas activity under Alternative A is expected to increase in scale from that described in the No Action Alternative. Activities such as resource survey and inventory would be of greater duration, and an increase in air traffic is expected. The amount of air traffic that occurs during the hunting season is a major complaint of the residents of the North Slope, who feel that the low-flying aircraft (planes and especially helicopters) disperse and relocate the game away from traditional hunting areas. ROP F-1 states that all aircraft use shall be conducted in a manner that will minimize impacts to wildlife and birds; however, the ambiguity of this ROP makes it especially hard to enforce.

Three oil-spill scenarios are considered in the IAP/EIS: a small spill (3 barrels of unrefined, or 29 gallons of refined oil), a large spill (500 to 149,999 barrels of oil), and a very large spill (over 150,000 barrels). Of the three spill scenarios, the probability of a large or very large spill is low, and small spills are expected to be contained and cleaned-up without causing notable impacts to resources. As a result, the effects of oil spills to subsistence resources or use are negligible, with only minor or short-term impacts anticipated.

Oil and gas activities that could occur under Alternative A throughout the Planning Area include leasing, exploration, and development/production. Leasing, in and of itself, would not affect subsistence resources or uses in the NPR-A, as it does not require on-the-ground activity. Exploration activity allowed under Alternative A includes seismic studies, both 2-D and 3-D; the drilling of exploration and delineation wells; and the construction of ice roads, landing strips, and remote exploratory staging areas. Development is expected to be carried out given two factors: 1) if substantial reserves are located, and 2) if the price of oil per barrel makes oil production profitable. Development involves permanent oil and gas infrastructure and facilities, such as pipelines, gravel roads, bridges, well pads, and airstrips.

As specified in the No Action Alternative, all exploration activities that will occur in the Planning Area under Alternative A will take place in the winter, as specified in Stipulation C-1, which states that ground operations are to begin only after the frost depth and snow cover have reached sufficient depths to meet tundra protection objectives, and will cease when the spring melt of snow begins. However, the effects of seismic exploration described under the No Action Alternative above would be increased threefold under Alternative A, as three seismic operations are expected to occur in the Planning Area each winter season.

Exploration operations (the drilling of exploratory wells) require the construction of ice roads and pads in order to move drill rigs and other heavy equipment to the remote drilling locations. Usually, only one exploratory well can be drilled per rig during a winter season, thus the number of exploratory wells drilled is dependent on the number of rigs in operation. Delineation wells are drilled around a positive exploration well (called the discovery well) to define the limits of a reservoir; and as many as 4 to 6 delineation wells can be drilled in a winter season on the exploratory ice pad or pads.

As was stated earlier, subsistence activities that occur during the winter--and therefore may be impacted by exploration operations--include furbearer trapping, fishing, and opportune hunting. Stipulation D-1 states that exploratory drilling in shallow lakes, streams, lake beds, or the active flood plain will only occur if the applicant can demonstrate that impacts to fish and wildlife are minimal. Ice roads constructed by the oil companies do not restrict movement of subsistence resources, and are frequently used by local residents for access to remote areas. Actual construction of the roads and ice pads could result in short-term displacement of furbearers or other small animals in the immediate area of construction, and water or ice withdrawal from lakes and streams could affect fish. However, Stipulation B-1 protects fish resources by not allowing water withdrawal from any lake less than 7 feet deep.

Under Alternative A, impacts as a result of development were analyzed using two different lease-sale scenarios: First Sale (meaning, what would be the result of *just* one lease sale) and Multiple Sales. Every analyst (Section IV.C) found that impacts to resources would increase under the multiple-sale scenario, given the increase in both exploration and subsequent development. However, most analysts concluded that the impacts to resources would remain negligible, short term, and not relevant at the population level (meaning that there would be no significant reduction in population). At issue for subsistence are two primary development infrastructures: gravel roads and pipelines. Traffic on gravel roads has been shown to disrupt or delay caribou movement, and pipeline(s) could impede movement to important insect-relief areas, depending on where development occurs. Although roads connecting to a road system or docks outside of the Planning Area are considered unlikely, if such a road were built, then more people could access the area, resulting in an increase in competition for fish and game resources.

Under Alternative A, between 230 and 740 miles of new pipeline are expected to be constructed, traveling from west to east, and connecting to Kuparuk through Alpine and/or TAPS through Umiat to Pump Station 2. These two potential pipeline corridors are located to the north and south of the community of Nuiqsut, through primary subsistence habitat, and are near the communities of Atqasuk and Barrow. Experience has shown that--while access for hunting and fishing is not restricted in development areas by law or policy--subsistence hunters are encouraged to stay away. Similarly, many hunters are wary to shoot or discharge firearms near pipelines or other development infrastructure.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in the NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in this EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. Other lands within the NPR-A that are managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. Lands outside of the NPR-A would not satisfy the congressional direction to explore and develop oil and gas resources within the NPR-A. State and Native Corporation Lands cannot be considered in a BLM plan.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS as alternatives and mitigation measures. Many of these measures have been taken into consideration, and have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The effects of Alternative A fall above the level of significantly restricting subsistence use for the community of Nuiqsut, and possibly also for the communities of Atqasuk and Barrow. The potential impacts to subsistence resources and access discussed above exceed the non-significant level; therefore, a positive determination pursuant to ANILCA § 810 is required. The distribution of caribou populations on the North Slope has been affected by Prudhoe Bay development, and access to subsistence resources currently is restricted there. Although procedures will be in place to ensure that future development affects access as little as possible, it is still probable that safety considerations will reduce the total area available for subsistence purposes. In addition, if development occurs in the insect-relief areas of the TLH, significant impacts to the productivity of the herd could result, thus affecting an important subsistence resource. This finding applies to the villages of Atqasuk, Barrow, and Nuiqsut.

D. Evaluation and Findings for Alternative B

Alternative B of the IAP/EIS would make all areas of the Northwest NPR-A Planning Area available for oil and gas leasing, with the exception of the proposed Kasegaluk Lagoon Special Area and in and along the shores of coastal bays and lagoons. One additional stipulation is added under Alternative B, increasing the total protective measures to 11 stipulations and 21 required operating procedures (ROP's). The protective measures included in Alternative B consist primarily of setbacks from 19 important waterbodies, deep-water lakes, waterfowl nesting and brood rearing areas, and coastal bays and lagoons. Additional oil- and gas-related activities--such as seismic exploration, test drilling, or the placement of permanent facilities--would only be undertaken after subsequent NEPA analyses.

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The evaluation for Alternative B is expected to be the same as that presented for Alternative A with regard to non-oil and gas activities and oil spill scenarios. Likewise, impacts to subsistence resources and access would remain the same as those discussed under Alternative A for oil and gas activities such as seismic operations, exploration activities and development. Although development in the Northwest NPR-A Planning Area is projected to be less in scope under Alternative B (less pipeline length to be constructed, fewer production pads), the pipeline routes as discussed in Alternative A stand.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in the NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in this EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. Other lands within the NPR-A that are managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. Lands outside of the NPR-A would not satisfy the congressional direction to explore and develop oil and gas resources within the NPR-A. State and Native Corporation Lands cannot be considered in a BLM plan.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS as alternatives and mitigation measures. Many of these measures have been taken into consideration, and have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The effects of Alternative B fall above the level of significantly restricting subsistence use for the community of Nuiqsut, and possibly also for the communities of Atqasuk and Barrow. The potential impacts to subsistence resources and access discussed above exceed the non-significant level; therefore, a positive determination pursuant to ANILCA § 810 is required. The distribution of caribou populations on the North Slope has been affected by Prudhoe Bay development, and access to subsistence resources currently is restricted there. Although procedures will be in place to ensure that future development affects access as little as possible, it is still probable that safety considerations will reduce the total area available for subsistence purposes. In addition, if development occurs in the insect-relief areas of the TLH, significant impacts to the productivity of the herd could result, thus affecting an important subsistence resource. This finding applies to the villages of Atqasuk, Barrow, and Nuiqsut.

E. Evaluation and Findings for Alternative C

Alternative C of the IAP/EIS provides substantial protection for biological resources in the Northwest NPR-A Planning Area. Several areas would not be available for leasing, including the proposed Kasegaluk Lagoon Special Area, three proposed wilderness study areas, and areas identified as being of concern for estuarine, deep-water lakes, and river and riparian habitat; caribou movement and migration areas; raptors, loons, brant, and eiders; cultural and paleontological resources; and subsistence cabins and camps. A total of 21 stipulations and 18 required operating procedures (ROP's) would be in place. Under this alternative, oil and gas development would be unlikely to occur.

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The evaluation for Alternative C is expected to be the same as that presented for Alternative B with regard to non-oil and gas activities and oil spill scenarios. With regard to oil and gas activities, because development is not expected to occur, disruptions to subsistence would only occur as a result of seismic operations, or other exploration. Subsistence activities that occur during the winter season, and therefore could be affected by seismic exploration include: furbearer trapping, fishing, and opportune hunting. Recent testimony by community members from Barrow and Nuiqsut has indicated that seismic exploration does interfere with overland travel by snow machine (SAP Minutes, June 6, 2002 meeting; Harry Brower, personal communication). Specifically, the deep ruts left in the snow by seismic vehicles create difficult terrain to traverse, and result in excessive wear-and-tear on both snow machines and the sleds that are pulled behind them. Replacement or repair of these tools that are used for subsistence harvesting is costly. However, despite the hindrance and annoyance, seismic exploration does not create a substantial barrier between communities and subsistence resources.

Exploration operations (the drilling of exploratory wells) requires the construction of ice roads and pads in order to move drill rigs and other heavy equipment to the remote drilling locations. Usually, only one exploratory well can be drilled per rig during a winter season, thus the number of exploratory wells drilled is dependent on the number of rigs in operation. Delineation wells are drilled around a positive exploration well (called the discovery well) to define the limits of a reservoir, and as many as 4 to 6 delineation wells can be drilled in a winter season on the exploratory ice pad or pads.

Stipulation D-1 states that exploratory drilling in shallow lakes, streams, lake beds, or the active flood plain will only occur if the applicant can demonstrate that impacts to fish and wildlife are minimal. Ice roads constructed by the oil companies do not restrict movement of subsistence resources, and are frequently used by local residents for access to remote areas. Actual construction of the roads and ice pads could result in short-term displacement of furbearers or other small animals in the immediate area of construction, and water or ice withdrawal from lakes and streams could affect fish. However, Stipulation B-1 prohibits the withdrawal of water from rivers and streams during the winter and protects fish resources by limiting the amount of water available for withdrawal from lakes, and Stipulation B-2 prohibits the compaction of snow cover or snow removal from fish-bearing waterbodies. Stipulation D-2 further protects subsistence resources by not allowing permanent oil and gas facilities during the exploration phase.

In the unlikely event that development would occur, Stipulation E-1 protects 22 rivers or creeks by not allowing permanent facilities within specified distances for each waterbody. For those waterbodies not listed by name, Stipulation E-3 states that permanent oil and gas facilities are prohibited upon or within 500 feet of any active floodplain, and Stipulation E-4 prohibits gravel mine sites within any active floodplain. Stipulation E-2 prohibits the construction of permanent roads that connect to a road system or docks outside of the Planning Area. As a result, there will be no easy access via a road system for other potential fish and game user groups (i.e., sport hunters, commercial fishermen). Therefore, there would be less competition for the resources in the Planning Area. Stipulation E-5 prohibits the construction of causeways and docks in river mouths or deltas. All of the above serve to protect fish and game resources and habitat from the potential negative effects of development.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in the NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in the EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. Other lands within the NPR-A that are managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. Lands outside of the NPR-A would not satisfy the congressional direction to explore and develop oil and gas resources within the NPR-A. State and Native Corporation Lands cannot be considered in a BLM plan.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS as alternatives and mitigation measures. Many of these measures have been taken into consideration, and have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The effects of Alternative C fall below the level of possibly significantly restricting subsistence uses and needs. The impacts to subsistence resources and access discussed above are minimal. This finding applies to all villages within the Planning Area.

F. Evaluation and Findings for the Cumulative Case

1. Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The cumulative case scenario includes potential adverse effects on subsistence uses and needs caused by existing and planned development activities, multiple lease sales proposed for the Northwest NPR-A Planning Area, possible additional sales in the remainder of the NPR-A, and other planned and reasonably foreseeable projects on the North Slope. Future activities could include Federal and State offshore lease sales. State and private onshore activities, and transportation of oil and gas by tankers or a pipeline. Whether any of these future activities actually would occur is not known, but the following discussion assumes that the development and production stage would occur. Section IV.F of the IAP/EIS contains a detailed description of the cumulative-case scenario, including the possible oil field and infrastructure development that this evaluation uses. This assessment and finding assumes that all future development in the NPR-A would be subject to the stipulations and required operating procedures (ROP's) proposed in this IAP/EIS.

The effects of the cumulative case so far exceed the effects of any action alternative for the Northwest NPR-A that there is no discernible difference in the level of cumulative effects under the Preferred Alternative,

Alternative A, Alternative B, Alternative C, or the No Action Alternative.

Cumulative effects on caribou-calving distribution are likely to be long term under all alternatives (including the No Action Alternative) over the life of the oil fields, but probably local within 1.86 to 2.48 miles (3 to 4 kilometers) of roads located within the calving areas. This reduction in calving and summer habitat used by cows and calves of the Central Arctic Herd (CAH), the TLH, and the Western Arctic Herd (WAH) caribou from future oil and gas activities, represents a functional loss of habitat that may result in a long-term effect on caribou herd productivity. The ranges of the CAH lead to more subsistence-hunting pressure on the TLH; however, this potential effect may not be measurable because of the great natural variability in caribou population productivity. Establishing the existence of a direct link to reduced harvests or access to subsistence resources under the cumulative case currently is difficult, but it is possible that these effects may exist in the future. The additional development pressure envisioned by the cumulative-case scenario could exacerbate changes in abundance and productivity of caribou and these changes may, in turn, adversely affect subsistence harvests.

Possible changes in caribou distribution patterns could also negatively affect subsistence hunters. For example, changes in the location of caribou calving areas may affect hunter success if calving caribou were to move to areas that were more difficult for subsistence hunters to access.

Access by subsistence users to the Prudhoe Bay oil fields currently is restricted. Stipulations proposed in this IAP/EIS are intended to limit such broad restrictions in the Planning Area, but some restrictions for the reasons of safety in the Planning Area as well as elsewhere could occur. Such a reduction to access could negatively affect subsistence users.

Any future gravel roads built from the NPR-A or any other North Slope development to the existing haul road could allow access to sport hunters, particularly if no restriction on hunting from or near the roads applies. Although it is unlikely that such a road would ever be built, and improbable that unrestricted access would be allowed, any increase in the numbers of hunters in the area would increase competition for caribou.

The cumulative effects on muskoxen, moose, wolves, and wolverines are likely to be local within about 1 or 2 miles of oil exploration and development facilities and resource inventory-survey activities and generally short-term, with no significant adverse effects on their populations under any of the alternatives considered in this EIS.

Although there would be more disturbance of waterfowl (including black brant) and, possibly, more small intermittent oil spills in the cumulative case, the overall effects on waterfowl are expected to be minimal under all alternatives. Even a major oil spill would not change this assessment because of the nesting and feeding patterns of the waterfowl present in the Arctic.

Fish habitat that is protected by setbacks would receive minimal impacts from most activities, although a major oil spill in the Colville River could significantly affect several fish species. While fish habitat would have more protection under Alternative B, Alternative C, and the Preferred Alternative than under Alternative A, the overall cumulative effects on fish would not be noticeably different under the various alternatives.

The offshore development and transport that is possible under a cumulative case could result in oil spills in the marine environment. Any oil spill that taints, or is perceived to taint, whale or other marine mammals of importance to subsistence users would have a significant negative effect on those users. If such a spill affected migration patterns or distributions of any marine mammal used for subsistence, it would also have significant negative effect on subsistence users. Under all alternatives, there should be little cumulative effect on any marine mammals from disturbance and noise, and access would not be affected.

From 1990 to 1997, the North Slope's permanent population grew at an annual rate of 2.7 percent, and Nuiqsut was the fastest growing village. This rate could continue for the foreseeable future with or without the development envisioned in the cumulative scenario discussed in the IAP/EIS. The effects of such growth on competition for subsistence resources are difficult to predict, but it is possible that over time there will be increased competition among local subsistence users. It is unlikely that the transient workers associated with oil and gas development will add to the competition, because they are ineligible for the subsistence priority under existing Federal regulations.

2. Evaluation of the Availability of Other Lands for Oil and Gas Exploration and Development

The Naval Petroleum Reserves Production Act of 1976 (NPRPA), as amended, gives the Secretary of the Interior the authority to conduct oil and gas leasing in the NPR-A. However, the law prohibited petroleum production from occurring in the NPR-A until authorized by Congress. In 1980, Congress granted that authorization and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. The BLM is undertaking this IAP/EIS to fulfill the mandates of the President's energy policy as well as BLM's responsibilities to manage these lands under authority of the NPRPA and other authorities cited elsewhere in this EIS. The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the National Petroleum Reserve-Alaska." The Planning Area under consideration was chosen because of its proximity to existing and future potential oil fields and its oil and gas potential. Other lands within the NPR-A managed by the BLM are either too remote for economically viable oil and gas production, or have a low probability of containing sufficient quantities of oil or gas. Lands outside of the NPR-A would not satisfy the congressional direction to explore and develop oil and gas resources within the NPR-A. State and Native Corporation Lands cannot be considered in a BLM plan.

3. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition

Other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes are presented in the main body IAP/EIS as alternatives and mitigation measures. Many of these measures have been taken into consideration, and have been incorporated as stipulations and ROP's for the various alternatives.

4. Findings

The cumulative case may significantly restrict subsistence resources or their use for caribou and requires a positive determination pursuant to ANILCA § 810 for all alternatives, including the No Action Alternative. The distribution of caribou populations on the North Slope has been affected by Prudhoe Bay development, and access to subsistence resources currently is restricted there. Although procedures will be in place to ensure that future development affects access as little as possible, it is still probable that safety considerations will reduce the total area available for subsistence purposes. If a major oil spill occurs in the future, it could significantly affect both populations and distributions of fish, whales and other marine animals, causing significant restrictions to subsistence resources. Population growth over the course of the plan results in a greater number of residents relying on local resources to meet their needs. In addition, construction of any road that would allow access to the area will allow for an increase in competition for subsistence resources by sport hunters. These restrictions have the potential to affect Barrow, Atqasuk, Nuiqsut, Wainwright, and Point Lay.

Although the effects of the Preferred Alternative, Alternative C, and the No Action Alternative fall below the threshold of may significantly restrict subsistence use, the addition of the cumulative case increases results in a level of effects that may significantly restrict subsistence use under those alternatives. Therefore, a positive ANILCA § 810 determination must be made for each of these three alternatives as well. The addition of the cumulative case to Alternatives A and B further increases the potential for effects to subsistence use by local residents, resulting in a definite positive finding under ANILCA § 810.

III. NOTICE AND HEARINGS

ANILCA § 810(a) provides that no "withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the public lands which would significantly restrict subsistence uses shall be effected" until the Federal Agency gives the required notice and holds a hearing in accordance with §810(a)(1) and (2). The BLM provided notice in the *Federal Register* that it has made positive findings pursuant to § 810 that Alternatives A and B in the IAP/EIS meet the may significantly restrict threshold. When the cumulative effects are considered, all alternatives exceed the may significantly restrict threshold. As a result, public hearings were held in the potentially affected communities of Anaktuvuk Pass, Atqasuk, Nuiqsut, Wainwright, Point Lay, and Barrow. Notice of these hearings was provided in the *Federal Register* and by way of the local media, including the *Arctic Sounder* newspaper and KBRW, the local Barrow radio station with coverage to all villages on the North Slope.

IV. SUBSISTENCE DETERMINATIONS UNDER § 810(a)(3)(A), (B), and (C)

ANILCA § 810(a) provides that no "withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the public lands which would significantly restrict subsistence uses shall be effected" until the Federal Agency gives the required notice and holds a hearing in accordance with §810(a)(1) and (2), and makes the three determinations required by § 810(a)(3)(A), (B), and (C). The three determinations that must be made are: 1) that such a significant restriction of subsistence use is necessary, consistent with sound management principles for the utilization of the public lands; 2) that the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other such disposition; and 3) that reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions [16 U.S.C. § 3120(a)(3)(A), (B), and (C)]. The BLM has found in this subsistence evaluation that all the alternatives considered in this IAP/EIS (including the no-action alternative), when considered together with all the past, present, and reasonably foreseeable future cumulative effects discussed in this EIS, may significantly restrict subsistence uses. Therefore, BLM undertook the notice and hearing procedures required by ANILCA § 810 (a)(1) and (2) in conjunction with release of the Draft EIS in order to solicit public comment from the potentially affected communities and subsistence users.

The determinations below satisfy the requirements of ANILCA § 810(a)(3)(A), (B), and (C).

A. Significant Restriction of Subsistence Use is Necessary, Consistent with Sound Management Principles for the Utilization of Public Lands

The BLM has prepared this IAP/EIS to fulfill the mandates of the President's energy policy and the responsibility to mange the NPR-A under the authority of two laws passed in 1976—the Naval Petroleum Reserves Production Act (NPRPA) and the Federal Land Policy and Management Act (FLPMA). The President's energy policy directs the Secretary of the Interior to "consider additional environmentally responsible oil and gas development, based on sound science and the best available technology, through further lease sales in the NPR-A." The NPRPA provides for "an expeditious program of competitive leasing of oil and gas" in the NPR-A "notwithstanding any other provision of law" (42 U.S.C. § 6508). At the same time, the statute also requires that all oil and gas activities "undertaken pursuant to this section shall include or provide for such conditions, restrictions, and prohibitions as the Secretary deems necessary or appropriate to mitigate reasonably foreseeable and significantly adverse effects on the surface resources" of the NPR-A (42 U.S.C. § 6508).

It was in furtherance of these objectives, together with other management guidance found in the NPRPA, FLPMA, NEPA, and ANILCA that this IAP/EIS was undertaken. After considering a broad range of alternatives, a Preferred Alternative was developed that provides for oil and gas leasing and also puts in place numerous protective designations and measures for important subsistence resources and subsistence-use areas. The consideration of where to allow leasing within the Planning Area and where to exclude it, and whether to prohibit surface occupancy or to provide other protective stipulations, required a careful balance of sound management principles as set out in the NPRPA, FLPMA, and other statutes. The resulting Preferred Alternative considers the necessity for economically feasible lease sales and also provides effective protections to minimize any impacts on subsistence resources and uses.

Under the Preferred Alternative, leasing will be deferred for ten years on 1,570,000 acres in the western portion of the Planning Area, now referred to as the "Deferral Area." The decision to forego leasing for ten years in this area was based in part on public testimony from the communities of Point Lay and Wainwright, who felt that oil and gas exploration and development was moving too fast to adequately study the effects on fish and wildlife. In addition, the Preferred Alternative precludes the construction of permanent facilities from within ¾ of a mile of the entire coastal area, within ½ mile of river, and ¼ mile from all deep-water lakes. Oil and gas exploration activities would only be allowed between October 15th and May 15th, and all overland activities will be conducted under specific Stipulations and Required Operating Procedures. Under the Preferred Alternative, Kasegaluk Lagoon is recommended for designation as a Special Area, with no surface occupancy. Special study areas would also be created for caribou and brant, where multi-year studies would be required prior to the authorization of development activities.

These measures and others contained in the stipulations applied to the Preferred Alternative were proposed specifically to ensure that subsistence resources and uses are not significantly restricted by the proposed action. Because of the numerous restrictions and protections incorporated as part of the Preferred Alternative, BLM has found that the Preferred Alternative by itself would not result in significant restrictions of subsistence resources and uses. However, considered together with past, present, and reasonably foreseeable future cumulative effects of possible oil and gas activities on adjacent lands, including state, privately owned, and offshore areas that are not under the BLM's control, the possibility exists that all the activities combined may significantly restrict subsistence uses.

The BLM has considered and balanced all of these factors; including, most prominently, the carefully crafted restrictions and limitations that were included in the Preferred Alternative to address subsistence concerns and to provide significant protection for subsistence resources and uses. The BLM has determined that the significant restriction that may occur under the Preferred Alternative--when considered together with all the possible impacts of the cumulative case--is necessary and is consistent with sound management principles for the use of these public lands, for the BLM to fulfill the management goals for the Planning Area as guided by the statutory directives in the NPRPA, FLPMA, and other applicable laws.

B. The Proposed Activity Will Involve the Minimal Amount of Public Lands Necessary to Accomplish the Purposes of Such Use, Occupancy, or Other Disposition

The BLM has determined that the Preferred Alternative involves the minimal amount of public lands necessary to accomplish the purposes of the IAP. Deciding where and how much land to make available for oil and gas leasing within the Planning Area involved the consideration of a number of factors, including where the high potential areas for oil and gas resources are found within the Planning Area; the location and amount of lands that are necessary for leasing to have an economically feasible leasing program; the importance of surface resources and uses; and the measures which can be taken to reduce or eliminate the possibility of a significant restriction on subsistence. Given these important factors, the process for determining which lands to offer for oil and gas leasing in the NPR-A did not focus only on minimizing the number of acres used for subsistence, although that was an important factor.

The BLM's approach was to balance the need to make sufficient lands available for leasing to achieve an economically feasible lease program while placing off-limits or restricting development activities on the lands that are most important for subsistence resources and uses. As described under (A), above, the Preferred Alternative accomplished this balance by protecting subsistence uses through surface occupancy restrictions such as setbacks, prohibitions on types of surface activities, and stipulations to protect important subsistence use areas on lakes and rivers and near existing subsistence camps and cabins.

The BLM has determined that the careful balance reflected in the Preferred Alternative involves the minimal amount of public lands necessary to accomplish the purposes of the IAP. The BLM has made available the minimum lands it has determined necessary to carry out its leasing program while stipulating oil and gas activities in the areas most important for subsistence resources and uses.

C. Reasonable Steps Will be Taken to Minimize Adverse Impacts upon Subsistence Users And Resources Resulting from Such Actions

When BLM began its NEPA scoping process for this IAP/EIS, it internally identified subsistence as one of the major issues that the IAP must address. The results of initial public scoping meetings in the villages of the North Slope supported this conclusion, and BLM held a workshop in Barrow with the NPR-A Subsistence Advisory Panel to further identify subsistence concerns and to seek ideas from subsistence users about how to address these concerns.

The BLM also took into consideration comments from the villages and individuals of the North Slope during the Subsistence Hearings conducted in conjunction with the draft IAP/EIS public meetings. In areas that are available for leasing, stringent protective measures for subsistence resources will be required, and include seasonal restrictions, setbacks, and limitations on the amount of water available for oil and gas uses. Impacts to the subsistence user are mitigated by detailed stipulations that apply to lands that are leased, and ROP's that apply to all lands in the Planning Area.

Adequate consultation has been identified as the most effective means of mitigating impacts to subsistence by the local and tribal governments of the communities on the North Slope. To this end, Stipulation H, Subsistence Consultation for Permitted Activities, requires the permittee to consult directly with affected communities, and defines in detail what constitutes adequate consultation. In addition, specific requirements are detailed for consultation with regard to seismic activities, an added protection that was not present in the Northeast NPR-A Plan.

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APPENDIX 6. FIRE MANAGEMENT

A. LAND USE PLAN DECISIONS

Fire is desired in all areas of the Northwest NPR-A so there are no constraints associated with the use of fire in the Planning Area. Fires will usually result from natural ignitions, although BLM may use management-ignited fires to improve vegetation conditions for specific resources.

B. FIRE MANAGEMENT CONSTRAINTS

The use of dozers or other large, mechanized equipment in the suppression of fire is prohibited in the Northwest NPR-A Planning Area.

The use of fire retardant in the suppression of fire is prohibited in any area of the Northwest NPR-A Planning Area where water resources may be impacted. Use of fire retardant would be allowed only after a Wildland Fire Situation Analysis has been conducted. No impact to water resources will be allowed.

Use of helicopters and fixed-wing, low-level aircraft is restricted during specific times of the year in certain areas to protect wildlife (Stipulations F-1 and F-2 under Alternative C; ROP F-1 under Alternatives A, B, and C; and ROP F-1 under the Preferred Alternative).

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The Nanushuk Group in Play 14 ranges from 1,000 to 10,000 ft thick (Bird, 1988c:fig. 16.18). The Nanushuk Group along the eastern boundary of NPR-A is overlain by up to 3,500 ft of Upper Cretaceous prodelta shales and fluvial-deltaic sandstones of the Colville Group that are also folded (Bird, 1988c:figs. 16.19, 16.20). The distribution of the Colville Group (identified as "Upper Cretaceous") is shown in Map 104. The Colville Group sandstones form potential petroleum reservoirs in the foldbelt in the eastern NPR-A, but are generally quite shallow and extend along fold axes directly to the land surface on the west. However, some Colville Group sandstones in the Gubik anticline are charged with gas (tested 2,060 Mcf of gas per day at Gubik No. 1; Molenaar, Bird, and Collett, 1986). Stratigraphic barriers providing western permeability seals on the east-plunging folds are required to complete the traps on some anticlines in the foldbelt province. Clay contents and compaction of

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River Formation at three of these wells.

Play 16. Sadlerochit-Arctic Platform-West (UBWA1600)

Play 16 covers 1,800 mi^2 and lies at drilling depths between 7,000 and 13,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 16 is shown in Map 101. The primary reservoir objective is the Triassic Ivishak sandstone of the Sadlerochit Group. Sandstones of the Sag River Formation may also contain petroleum. The Ivishak sandstone ranges from 0 to 150 ft thick within the play area and average porosities range

Appendix 7. Oil and Gas Resource Assessment

A. Introduction

The environmental impacts associated with future oil and gas activities are assumed to be correlated to the economic petroleum potential. That is, higher levels of development are likely to be associated with higher levels of impacts. However, there is no way to accurately predict when or how much of the theoretical (undiscovered) petroleum potential will actually be converted to future production. For the basic oil and gas resource analysis, it is assumed that the entire Planning Area will be open to unrestricted leasing, exploration, and development. It is also assumed that the entire economic fraction of the resource endowment (that part occurring in large pools that can be developed profitably at certain commodity prices) will be both discovered and developed by industry. However, it is acknowledged that it is unlikely that all prospects will be tested or that all economic resources will be discovered by drilling. It is also acknowledged that some restrictions on exploration and development activities will likely apply. Typically, the largest fields are discovered and developed first, and subsequent discoveries are smaller and more costly to develop on a per-barrel basis. At some point, exploration capital is directed to other basins and some of the potentially economic resources are left in the ground. Industry groups could easily lose interest in exploration at any time after a number of costly dry wells. Without an aggressive exploration effort the full potential of the area may never be realized. Even with aggressive exploration, the economically recoverable oil and gas typically represents only a small fraction of the total endowments of recoverable oil and gas.

It is conceivable that future technological advancements will lead to a decrease in oil/gas finding and recovery costs and thereby increase the fraction of resources that can be economically recovered. However, the effects of unknown future technological advances cannot be addressed at this time.

For this assessment, both hypothetical, undiscovered pools and discovered pools were considered for their economic potential. However, discovered pools were treated separately from the population of hypothetical, undiscovered pools.

Pools discovered prior to 1999 have published, mean reserves that are patently too small to support economic development. Some of these discoveries have remained undeveloped for many decades. For example, the Umiat oil field was discovered in 1946, and mean oil reserves are estimated to be 70 MMbbl. However, the Umiat field is viewed as uneconomic because expected low well production rates would not generate revenues sufficient to overcome the high costs associated with development of the field and construction of a lengthy pipeline connecting Umiat to existing North Slope infrastructure. We acknowledge that discovered pools with published reserve estimates have the potential for larger recoverable volumes at low probabilities (i.e., it is possible, but very unlikely, that volumes in excess of published reserves could be recovered). Some of the discovered pools are now available for leasing and might even attract bids from companies willing to gamble against the low probability for high-side reserve volumes. However, in our economic model, these high risks burden hypothetical projects and render them uneconomic even when larger reserves are entertained.

Discoveries announced since 1999 (Table III-01) do not yet have published reserve estimates. These discoveries are not fully appraised in terms of pool size and only represent "discoveries" in the sense that significant oil or gas flow rates were measured from certain geological strata. It is not known whether any of these discoveries will prove to be sufficiently large to justify development. The post-1999 discoveries were removed (for statistical reasons) from the population of hypothetical, undiscovered pools that were explicitly evaluated by the economic model. However, a full spectrum of sizes of undiscovered pools--probably fully representative of the possible sizes of the new (and pre-1999) discoveries--were subjected to economic simulation analysis and in the end could have contributed to the economic endowment.

Two computer models--developed by MMS for offshore resource assessment--were used in evaluating the combined Northwest and Northeast NPR-A Planning Areas. Descriptions of how these computer models were developed and used in the recently completed 1995 National Resource Assessment are provided in USDOI, MMS (1996e) and Sherwood (ed.), (1998). These two computer programs are summarized here.

The Geologic Resource Assessment Program (GRASP) calculates the conventionally recoverable resource potential or "geologic potential." Geologic characteristics of reservoirs and plays are input as ranged variables (in the form of probability distributions) which are sampled randomly ("Monte Carlo" sampling) to determine pool numbers and size. The primary output includes cumulative frequency (or probability distributions) for total oil, gas, and barrels of oil equivalent (BOE) volumes, and a pool rank (or size) distribution for each assessed geologic play. The pool rank distribution displays the number of accumulations expected, with sizes ranked from largest to smallest. These data represent the hydrocarbon pools expected in the assessment area. The output of GRASP is sampled as part of the data used by the Probabilistic Resource Estimates-Offshore (PRESTO) model.

The PRESTO model performs a discovery/development/production simulation and a discounted cash flow analysis for each hypothetical pool forecast by the GRASP model. In a given trial, pools with positive net present value are considered to be commercially viable and therefore, contribute to the play's economic resources. Economic play resources are then summed to create the total economic potential of the assessment area. The economic analysis proceeds as a series of simulation runs at different commodity prices, and the results are displayed in price-supply curves. Higher commodity prices support an increase in the resource volumes that are profitable to produce. At very high (perhaps unrealistic) prices, the economically recoverable resource volume approaches the conventionally recoverable resource volume calculated by the GRASP model.

B. Geologic Assessment

It is important to acknowledge that resource assessments are built on a constantly changing database and most should be viewed as updates of previous work. This is the case for the present assessment. Numerous oil and gas resource assessments have been conducted in the NPR-A (Bird and Powers, 1988). The most recent assessment was completed in 1997 by MMS and BLM as part of the Northeast NPR-A IAP/EIS process (Craig and Sherwood, 1999). In 1995, the U.S. Geological Survey (USGS) completed a regional assessment of all of northern Alaska (Bird, 1995; Attanasi and Bird, 1995) but offered no separate estimates for the NPR-A. The USGS recently completed a new oil and gas assessment of the entire NPR-A, and a summary of results was released in May 2002 (Bird and Houseknecht, 2002a; 2002b). However, the USGS assessment does not provide resource estimates specifically for the Northwest and Northeast NPR-A Planning Areas. Accordingly, MMS and BLM independently assessed the oil and gas potential of the combined Northwest and Northeast NPR-A Planning Areas in support of environmental studies of the impacts of proposed leasing programs. The MMS/BLM assessment was completed in April 2002. A comparison of the results of the 2002 MMS/BLM and USGS assessments is provided in this appendix.

The overall assessment is organized around fundamental units called geologic plays. A play is a group of prospects that share attributes of origination such as trapping mechanism, reservoir stratigraphy, hydrocarbon source, and migration/charging history. Prospects are untested traps that could contain hydrocarbons (oil or gas or a combination of both). Typically, most prospects within a play are "dry" (devoid of recoverable hydrocarbons). The fraction of all of the prospects within a play that may contain hydrocarbons (rather than water) can be viewed as a success rate for the play. If exploration statistics or subjective estimates indicate an overall chance of success of 0.15, then 15 oil or gas pools would be expected to exist among a population of 100 prospects. Using this play approach, the general information about the geology of an area can be converted into estimates of resource potential.

1. Summary of Plays

Identifying geologic plays in the NPR-A began with the grouping of plays based on stratigraphic association. For example, the "Beaufortian" and "Brookian" play groups--as well as play groups within the Ellesmerian sequence (Endicott, Lisburne, and Sadlerochit Groups)--were identified. The stratigraphic column for the NPR-A (Figure III-01) illustrates the major sequences and play groups. Although stratigraphy is the basis for the most fundamental play groupings, further separations and groupings are based on the temperature environment for hydrocarbons and the structural setting.

Some plays are very deeply buried, offering potential for gas resources exclusively, so they must be set apart from oil-bearing plays. The oil potential for a play depends upon reservoir temperature or source type. The rocks underlying NPR-A pass from shallow depths (a few thousand ft) in the north to depths exceeding 36,000 ft in the south. This depth range corresponds to a range in reservoir temperatures from 32 to 585° F (Deming et. al., 1992)[1]. Rocks subjected to temperatures over 400° F will contain only natural gas because at that temperature, heat-driven chemical reactions break petroleum liquids molecules into smaller petroleum gas molecules. In addition, carbon-rich source rocks heated to these temperatures can only generate gas.

Rocks subjected to temperatures exceeding 400° F record this heating event with vitrinite reflectances exceeding 2.0%. Vitrinite reflectances are measured routinely in samples from wells, allowing the mapping of the thermal histories of rocks. Vitrinite reflectances exceeding 2.0% are achieved at depths more than 17,000 ft in the northern parts of the NPR-A. In the southern parts of the NPR-A and along Meade Arch, the 2.0% vitrinite reflectance isograd[2] lies at depths of 7,500 ft (subsea) or less.

Most of the geologic column in the southern NPR-A lies deeper than the 2.0% vitrinite reflectance isograd and offers the potential for gas only. By contrast, most of the geologic column in northern parts of the NPR-A lies above the 2.0% vitrinite reflectance isograd and any oil deposits in this area have probably survived thermal destruction. The lines formed by the intersection of the 2.0% vitrinite reflectance isograd and the stratigraphic tops of play sequences form the northern boundaries of the "gas belts" as shown in the play maps (see Map 99, Map 100, Map 101, Map 102, Map 103, and Map 104). In areas south of the 2.0% isograd lines, the respective play sequences offer potential for natural gas only. The cross section in Figure III-02 illustrates the relationship between thermal maturity isograds and regional structure of rock sequences in the NPR-A.

Play groups were further subdivided on the basis of proximity to the Barrow Arch, a buried ridge along the Beaufort Sea coast (Map 27).Generally, Ellesmerian and Beaufortian rocks near Barrow Arch were deposited in a more proximal setting (closer to source terrane sediment transport direction) and offer clean, porous sandstones (desirable as petroleum reservoirs) that grade into muddy, non-porous rocks to the south.

Most importantly, the Barrow Arch served as a regional destination for hydrocarbons migrating updip within permeable formations from oil-generating areas beneath the Colville basin (Figure III-02). With the exception of Play 8 (Beaufortian-Barrow Arch-East) and Play 17 (Beaufortian-Barrow Arch-West), the southern boundary of the Barrow Arch plays used in this assessment is the same as that adopted by the USGS in their 1995 assessment. The southern boundary of the USGS Barrow Arch plays is described as "arbitrarily selected as the down-dip limit (on the south flank of the Barrow Arch) of the characteristic structural-stratigraphic traps" (Bird, 1995: pp. 16 and 25).

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The "Arctic platform" plays occupy the areas between the oil-rich Barrow Arch on the north and the deeply buried gas plays on the south. They offer an intermediate burial environment and a mix of oil and gas resources. The Arctic platform and Barrow Arch play groups are further separated into those areas lying east or west of Meade Arch, which passes south from Point Barrow (Map 27). Meade Arch was chosen as the geologic line of separation between gas-prone plays on the west and oil-prone plays on the east.

Along the Beaufort Sea coast, the westernmost occurrence of pooled oil is in the Simpson field and overlying surface oil seeps (Map 26). In the south, the westernmost occurrence of pooled oil is at the Umiat Oil field. West of the Simpson and Umiat pools we find an area dominated by natural gas; all five known pools (Meade, South Barrow, East Barrow, Sikulik, and Walakpa) are comprised of natural gas. However, this is not to say that liquid hydrocarbons are entirely absent from western NPR-A. Wells in western NPR-A have encountered minor oil shows and some wells in the South Barrow gas field have produced very small quantities of liquid hydrocarbons (Bird, 1988: table 15.5; Magoon and Claypool, 1988: table 21.1). However, most geologic indicators and the results of exploration drilling indicate that western NPR-A is gas-prone. Wells are sparse and widely scattered in central and western NPR-A, making it difficult to determine exactly where oil-prone plays in the east grade into the gas-prone plays in the west. Lacking more detailed well control, we assume that Meade Arch has influenced oil and gas migration in ways that guided oil to the east and gas to the west. For this reason, the crest of Meade Arch is chosen (for purposes of this assessment) as the boundary between oil-prone plays on the east and correlative, but gas-prone plays on the west.

The principal oil source rocks in Northwest NPR-A passed from the temperature interval for oil generation to gas generation approximately 95 million years ago. The same oil source rocks remain within the temperature interval for oil generation in Northeast NPR-A. Accordingly, the thermal maturity of the oil source rocks is much higher (or gas prone) in Northwest NPR-A (Johnsson and Howell, 1996:pl. 1). Even today, heat flow and geothermal gradients are typically higher in Northwest NPR-A than Northeast NPR-A (Deming et al., 1992: figs. 6b and 8b). For Northwest NPR-A, the geologic context predicts a gas-prone province. The widespread gas shows in exploratory wells and discovered gas pools confirm this inference. For this reason, most plays were divided into east and west parts. This division allowed the models to treat the parts with oil-prone and gas-prone characterizations separately. The crest of Meade Arch, as mapped by Kirschner and Rycerski (1988: pl. 9.1) and shown in Map 27 was chosen as the line of east-west separation for gas-prone plays on the west and oil-prone plays on the east.

Potential reservoirs in the Brookian sequence occur in two highly dissimilar depositional settings. In the lower part of the sequence, turbidite sandstones (formed by subsea avalanches of slurries of sediment and water that move down-slope) were deposited at slope bases in the submerged, deep-marine parts of deltas. In the upper part of the sequence, fluvial to shallow marine sandstones were deposited near delta shorelines (Molenaar, 1988). These different depositional environments typically produce different reservoir characteristics (thickness, lateral continuity, and potential storage volumes) that require treatment as separate plays.

In the belt of deformed rocks lying north of the Brooks Range, there are representatives from each play group. These plays were cut by faults and deformed into complex folds by the compressive forces that created the Brooks Range in multiple events between 170 and 65 million years ago. This deformed belt displays multi-storied thrust plates containing structures unlike those in overlying or underlying thrust plates. Five of these plays contained deformed rocks within and north of the Brooks Range. Four of these plays were assessed for this plan. The fifth play (Play 21) lies south of the combined Northwest and Northeast NPR-A Planning Areas, so it is not considered in this assessment.

2. Descriptions of Plays

The play analysis recognizes 23 plays within the NPR-A. Each one is briefly described below, with play areas shown in Maps 99-104.

Play 1. Endicott-Barrow Arch (UBWA0100)

Play 1 covers 600 mi^2 and lies between drilling depths of 8,000 and 12,000 ft within the combined Northwest and Northeast NPR-A Planning Areas. The area of Play 1 is shown in Map 99. The reservoir objectives are Lower Mississippian Endicott Group quartz-rich sandstones of fluvial to shallow-marine origins, deposited in structural depressions in the eroded surface atop basement. Endicott Group rocks thin toward regional arches and are generally absent from arch crests. The Endicott Group is less than 1,000 ft thick within the play area (Bird, 1988c: fig. 16.10). These rocks are absent from Fish Creek platform (hachured area labeled "Endicott Absent" south of J.W. Dalton well in Map 99). Wedges of Endicott sandstones flanking Fish Creek platform may host stratigraphic traps. Otherwise, potential traps are associated with subtle anticlinal structures and fault structures revealed by seismic mapping of the top of acoustic basement. Petroleum charging for Play 1 was probably from thermally mature Shublik, Kingak, and Pebble Shale Formations deeply buried on the south, or possibly from petroleum migrating northwest along Barrow Arch from the Prudhoe Bay area. Play 1 has been penetrated by seven wells, two of which (East Simpson 2, J.W. Dalton) tested minor amounts of asphaltic crude oil from the Endicott Group.

Play 2. Endicott-Arctic Platform (UBWA0200)

Play 2 covers 1,600 mi ^{2} and lies between drilling depths of 8,000 and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 2 is shown in Map 99. The reservoir objectives are Lower Mississippian Endicott Group quartz-rich sandstones of fluvial to shallow-marine origins, deposited in structural depressions in the erosional surface atop basement. The play sequence (Endicott Group) is present throughout the play area, but is generally less than 1,000 ft thick (Bird, 1988c:fig. 16.10). Play 2 extends westward to Meade Arch where the Endicott Group is absent. Subtle stratigraphic traps may occur in the southern part of the play area along the flexure forming the north edge of the Ikpikpuk-Umiat basin. Truncated wedges of Endicott sandstones flanking Meade Arch may host stratigraphic traps. The history of deeper burial at Play 2 has probably diminished reservoir pore systems more than in Play 1. Play 2 is considered more gas-prone than correlative Play 1 along Barrow Arch. Petroleum charging for Play 2 was probably from gas-prone shales within the lower part of the Ellesmerian sequence to the south in the Ikpikpuk-Umiat basin. The Topogoruk, South Simpson, and West Fish Creek wells, (none of which tested hydrocarbons from the Endicott Group) penetrated Play 2.

Play 3. Ellesmerian (All)-Gas Belt (UBWA0300)

Play 3 covers a maximum of 14,500 mi^2 and lies between depths of 12,000 and 32,000 ft within the Northwest and Northeast NPR-A Planning Areas (maximum area of Play 3 within NPR-A is 22,036 mi^2). Play 3 includes all of the Ellesmerian sequence reservoir objectives (Endicott, Lisburne, and Sadlerochit) south of intersections with their respective 2.0% vitrinite reflectance isograds, where they are so deeply buried that only natural gas has survived thermal destruction. The play areas change for different formations within the Ellesmerian sequence because the 2.0% vitrinite reflectance isograd intersects the deepest formations the farthest north (see Fig. III-02). The area of Endicott rocks (16,700 mi^2 all NPR-A, 11,200 mi^2 within Northwest and Northeast NPR-A Planning Area) within Play 3 is shown in Map 99. The area of Lisburne rocks (22,000 mi^2 all NPR-A, 14,500 mi^2 within Northwest and Northeast NPR-A Planning Areas) within Play 3 is shown in Map 100. The area of Sadlerochit rocks within Play 3 (20,400 mi^2 all NPR-A, 12,800 mi^2 within Northwest and Northeast NPR-A Planning Areas) is shown in Map 101. Endicott strata are absent from most parts of Meade and Wainwright Arches, both passing south from Barrow (Map 99). In the Ikpikpuk and Meade basins, the Endicott Group reaches 10,000 ft in thickness (Bird, 1988c:fig. 16.10). Within the play area, the Lisburne Group ranges from 1,000 to 6,000 ft thick (Bird, 1988c:fig. 16.11) and the Sadlerochit Group ranges from 500 to 3,500 ft thick (Bird, 1988c:fig. 16.12).

Potential traps consist of fault structures in the south, stratigraphic traps along the north flank of the Ikpikpuk-Umiat basin or the flanks of Meade Arch, and some wrench fault structures affecting Endicott strata within the Ikpikpuk-Umiat basin (one tested by the Inigok well). The rocks in Play 3 pass southward beneath a belt of thrust faults and folds in correlative rocks that are related to Brooks Range deformation, the latter analyzed separately as Play 21.

Because of the history of deep burial, reservoir pore systems in Play 3 are predicted to be greatly diminished. Play charging was originally from gas-prone and possibly oil-prone[3] strata within the Ellesmerian sequence, but any trapped liquid hydrocarbons have been cracked to natural gas. The Tunalik, South Meade, Inigok, North Inigok, and Ikpikpuk wells penetrated Play 3. Minor gas, hydrogen sulfide, and elemental sulfur was encountered within the Lisburne Group at the Inigok well (Magoon and others, 1988:pl. 19.21).

Play 4. Lisburne-Barrow Arch (UBWA0400)

Play 4 covers 750 mi^2 and lies between drilling depths of 8,000 and 10,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 4 is shown in (Map 100). Reservoir objectives include porous dolomites and (possibly) limestones of Mississippian to Pennsylvanian age within the Lisburne Group. The Lisburne Group thins over structural highs like Fish Creek platform and is completely absent by onlap from a large part of the northern NPR-A (Map 100). Generally, the Lisburne Group is no more than 2,000 ft thick within the area of Play 4 but thickens southward (Bird, 1988c:fig. 16.11). Potential traps are mostly associated with subtle anticlinal structures along Fish Creek platform and regional truncations at an unconformity at the base of the Sadlerochit Group. Petroleum charging for this play was probably from thermally mature Shublik, Kingak, and Pebble Shale Formations deeply buried on the south, or from petroleum migrating northwest along Barrow Arch from the Prudhoe Bay area. Seven wells have penetrated Play 4. Minor amounts of oil or asphaltic material were recovered from Lisburne Group rocks at the J.W. Dalton and W.T. Foran wells.

Play 5. Lisburne-Arctic Platform (UBWA0500)

Play 5 covers 3,800 mi^2 and lies between drilling depths of 9,000 and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 5 is shown in Map 100. Reservoir objectives include porous dolomites and (possibly) limestones of Mississippian - Permian[4] age within the Lisburne Group. The Lisburne Group thickens southward in Play 5, ranging in thickness from zero on the west at the Meade Arch to over 4,000 ft in the Ikpikpuk-Umiat basin (Bird, 1988c:fig. 16.11). Potential traps are small anticlinal structures and subtle stratigraphic-wedge traps, mostly along the flexure forming the northern boundary of the Ikpikpuk-Umiat basin. Play 5 is considered more gas-prone than the correlative Play 4 along Barrow Arch, and greater burial has probably furthered the destruction of porosity in the carbonate reservoir rocks of Play 5. Petroleum charging for this play was probably from gas-prone shales within the Lisburne Group and shales and coals within the Endicott Group that are deeply buried to the south of the play area. The Ikpikpuk, East Teshekpuk, and West Fish Creek wells penetrated Play 5. None of these wells tested hydrocarbons from the Lisburne Group.

Play 6. Sadlerochit/Sag River-Barrow Arch-East (UBWA0600)

Play 6 covers 1,600 mi^2 and lies between depths of 7,000 and 9,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 6 is shown in Map 101. The primary reservoir objective is the Triassic Ivishak sandstone of the Sadlerochit Group. Sandstones of the Sag River Formation may also reservoir petroleum, but these more typically lack porosity and would form a secondary or supplemental reservoir objective. The Sadlerochit Group ranges in thickness from zero to 1,200 ft within the play area (Bird, 1988c:fig. 16.12). The Sadlerochit Group is absent from the parts of the NPR-A north of the Simpson field (Map 26 and Map 101). However, rocks of the Sag River and Shublik Formations, which are included within this play, extend throughout most of the play area north of the Simpson field where the Sadlerochit Group is absent. The Ivishak sandstone thins to less than 100 ft over structural highs like the Fish Creek platform, but ranges over 400 ft thick within the play area. Average porosities range from 7% to 15% in the play area, reflecting a more marine and sand-poor, or shaly, facies than prevailed to the east in the fan-delta braided-stream systems at Prudhoe Bay[7]. Potential traps are stratigraphic wedges produced by truncation of reservoir sandstones in the northernmost part of the play area, and subtle anticlinal structures along the Fish Creek platform. Petroleum charging for this play was probably from thermally mature Shublik, Kingak, and Pebble Shale Formations deeply buried on the south, or from petroleum migrating northwest along Barrow Arch from the Prudhoe Bay area. At Meade Arch, Play 6 passes west into the correlative (but gas-prone) Play 15. Play 6 was penetrated by 15 wells within the NPR-A and targeted by seven wells offshore. Within the NPR-A, minor amounts of oil or gas were tested at the East Simpson 1, Simpson 1, W.T. Foran, and J.W. Dalton wells. A small amount of oil was tested from the Shublik and Sag River Formations at the Iko Bay well. The Mukluk, Mars, Orion, Antares (#1 and #2), Phoenix, and Fireweed wells (located in Map 101) tested the offshore extension of Play 6 (Map 101). All offshore wells and several NPR-A wells were drilled to test Sadlerochit Group rocks in stratigraphic wedges beneath the Lower Cretaceous unconformity, which are analogous to the trap mechanism at Prudhoe Bay field. The Sadlerochit Group was absent at Orion well. Minor amounts of oil were tested from the play sequence at the Antares #1 well. Significant oil shows, but no pooled oil, were encountered in Sadlerochit Group rocks at Mukluk, Phoenix, Fireweed, and Mars wells. The Mukluk well, drilled at a cost of $120 million on a block of leases acquired for over $1.5 billion in high-bonus bids, is one of the most legendary exploration failures in the history of petroleum development in Alaska.

Play 7. Sadlerochit-Arctic Platform-East (UBWA0700)

Play 7 covers 6,100 mi^2 and lies between drilling depths of 7,000 and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 7 is shown in Map 101. The primary reservoir objective is the Triassic Ivishak sandstone of the Sadlerochit Group. Sandstones of the Sag River Formation may also reservoir petroleum, but these typically lack porosity. The Sadlerochit Group ranges from zero to 1,500 ft thick within the play area (Bird, 1988c:fig. 16.12). The Ivishak sandstone ranges in thickness from 100 to 300 ft within the play area and average porosities range from 0 to 15%, reflecting a more distal (offshore and deeper water) and shaly facies than prevailed in Play 6 to the north along the Barrow Arch (where mapped average porosities range from 7 to 15 percent). A history of deeper burial for Play 7 also contributes to diminished reservoir properties relative to Play 6. Potential traps are mostly small anticlinal structures along the southeastern extremity of Fish Creek platform and possibly stratigraphic truncations in the Simpson area. Petroleum charging for this play was probably from the thermally mature Shublik Formation deeply buried on the south. At Meade Arch, Play 7 passes westward into the correlative (but gas-dominated) Play 16. At its southern limit along the 2.0% vitrinite reflectance isograd, Play 7 passes into the Ellesmerian (All)-Gas Belt Play 3. The Topogoruk, South Simpson, Ikpikpuk, North Inigok, and West Fish Creek wells penetrated Play 7. No hydrocarbons were tested from the Sadlerochit Group in any of these wells.

Play 8. Beaufortian-Barrow Arch-East (UBWA0800)

Play 8 covers 5,200 mi^2 and lies between drilling depths of 2,000 and 11,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 8 is shown in Map 102. Play 8 was expanded southward for this assessment, and now includes the northern parts of Play 9 (Beaufortian-Arctic Platform-East) as mapped in the 1997 assessment of the Northeast NPR-A Planning Area (Craig and Sherwood, 1998). The southward expansion of Play 8 reflects the results of seismic mapping and exploration drilling since the 1997 assessment. The Beaufortian sequence ranges from 200 to 1,400 ft thick within the area of Play 8 (Bird, 1988c:figs. 16.15, 16.16). Reservoir objectives include the Cretaceous Kuparuk "C" sandstone[8], three Jurassic sandstones (the

"Alpine," "Nuiqsut," and "Nechelik" sandstones of Kornbrath et al., 1997), and the Upper Jurassic Simpson sandstone (Bird, 1988a:fig. 4.13). These sandstones offer multiple reservoir opportunities within the play, but probably do not overlap in the area of any single prospect. The "Alpine" sandstone, forming the reservoir at the 500-MMbbl Alpine oil field, is probably absent from the northern third of Play 8 because it is truncated by the Lower Cretaceous unconformity. At the Alpine field discovery well, the Alpine sandstone is about 52 ft thick with 47 ft of oil pay. In publicly available wells outside of Alpine field, the Alpine sandstone is extremely thin or represented by shale (Kornbrath et al., 1997: table 5). The Nuiqsut sandstone ranges in thickness from 152 to 224 ft in the Colville delta area east of the NPR-A (Kornbrath et al., 1997). The Nechelik sandstone ranges from 25 to 65 ft thick (Kornbrath et al., 1997:table 5) in the Colville delta wells.

The Kingak and Kuparuk Formations are truncated at the Lower Cretaceous unconformity in an area along the northern coast of the NPR-A (mapped in Map 102). Only the Pebble Shale and related unconformity sandstones (Kuparuk "C") represent the Beaufortian sequence in the truncation area. Potential traps that are easily recognized in seismic data are subtle anticlines along Fish Creek platform and stratigraphic wedges created by erosional truncations at the Lower Cretaceous unconformity. Additional traps are probably associated with sandstone bodies isolated within shales. The Alpine field represents this type of stratigraphic trap. These stratigraphic traps are revealed only in 3-D seismic data as areas of anomalous seismic amplitudes (described by Gingrich, Knock, and Masters, 2001). The MMS and BLM have used 3-D seismic data covering approximately 924 mi^2 in the Northeast NPR-A Planning Area (18% of total play area) to identify seismic amplitude anomalies that might reveal bodies of porous or hydrocarbon-saturated sandstones. The results of this mapping were extrapolated to the remainder of the play area to estimate the number and size range of prospects. The net effect of this extrapolation is a near doubling of prospect density (number of prospects per unit area) above the 1997 assessment of Play 8 in the Northeast NPR-A Planning Area IAP/EIS. The 3-D seismic mapping used in this assessment contributed to a substantial increase in the estimates for undiscovered oil and gas resources in Play 8.

Petroleum charging for Play 8 was probably from thermally mature Shublik, Kingak, and Pebble Shale Formations that are more deeply buried on the south. The Kingak Formation has been identified as the source for the low-sulfur, high-gravity (40 ° API) oil at Alpine field (Masterson, 2001:p. 25) and it is presumed to be the primary generating source for oil resources across Play 8. The low viscosity (high gravity) crude oils anticipated for Play 8 move easily through pore systems and are more efficiently recovered from reservoirs. High-gravity oils also attract a higher market price. For these reasons, the high-gravity oils are an important element of the commercial viability for the Alpine play. However, some pools within the play could contain relatively high-viscosity "Barrow-Prudhoe" type crude oils (high sulfur) averaging 28° API gravity, as found in the Kuparuk, Nuiqsut, and Nechelik sandstones in the Colville delta area (Kornbrath et al., 1997:table 5). These high-viscosity oils do not pass easily through the pore systems of the muddy Alpine sandstones and offer challenges to commercial development. Play 8 is separated along Meade Arch from a correlative gas-prone play (17) to the west that includes Walakpa gas field and the Barrow area gas fields.

Thirty-three wells penetrated Play 8 in the NPR-A, including fourteen wells drilled on leases acquired in 1999. Minor amounts of gas or oil were encountered at the W.T. Foran and West Dease wells. The North Inigok well tested 80 thousand cubic feet per day (Mcfd) of gas from Alpine-equivalent sandstone. The South Simpson well tested 75 Mcfd of gas from the Simpson sandstone (Bird, 1988: table 15.5). Fourteen exploration wells (including one sidetrack well) were drilled on 1999-acquired leases in the Northeast NPR-A (Map 26). No announcements have been made concerning the Trailblazer A-1 and Trailblazer H-1 wells drilled by BP Exploration (Alaska) Inc. or the Puviaq 1 well completed in 2003 by Conoco-Phillips. Conoco-Phillips Alaska announced in 2001 that one of its seven exploration wells was a dry hole, but five wells and a sidetrack well encountered oil or gas and condensate. Long-term flow testing at the Spark 1A well produced 1,550 bbl of liquid hydrocarbons and 26.5 million cubic ft per day (MMcfd) of gas. Long-term flow testing at the Rendezvous "A" well produced 360 barrels per day (bpd) of liquid hydrocarbons and 6.6 million cubic ft per day (MMcfd) of gas. Long-term testing at the Lookout 2 well produced 4,000 bpd and 8 MMcfd. All of these exploration wells are located 15 to 25 mi southwest of the 500-million-barrel Alpine field, now producing over 100,000 bpd (Petroleum News Bulletin, 2002). All of these exploration wells targeted the Alpine field reservoir formation that occurs within the "Beaufortian" play group. The recent exploration wells are shown on Map 26 and the public announcements of test results are listed in Table III-01.

Play 9. Beaufortian-Arctic Platform-East (UBWA0900)

Play 9 covers 4,000 mi^2 and lies between drilling depths of 8,000 and 17,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 9 is shown in Map 102. The Beaufortian sequence ranges from 1,700 to 3,700 ft thick within the play area (Bird, 1988c: figs. 16.15 and 16.16). Reservoir objectives include the Cretaceous Kuparuk "C" sandstone, three sandstones within the upper part of the Jurassic Kingak Formation ("Alpine," "Nuiqsut," and "Nechelik" sandstones of Kornbrath et al., 1997), and the "Simpson" sandstone occurring in the lower part of the Jurassic Kingak Formation in northwestern parts of Play 9.

The Simpson sandstones are present only in the northwestern-most part of the play area and they range from 110 to 180 ft thick (Bird, 1982). The three Upper Jurassic sandstones may be locally present anywhere within the play area. At the Alpine field discovery well, the Alpine sandstone is about 52 ft thick with 47 ft of oil pay. In publicly available wells outside Alpine field, the Alpine sandstone is extremely thin or represented by shale (Kornbrath et al., 1997:table 5). The Nuiqsut sandstone ranges from 152 to 224 ft thick. The Nechelik sandstone ranges in thickness from 25 to 65 ft (Kornbrath et al., 1997:table 5). Although these sandstones offer multiple reservoir opportunities within the play, they probably do not actually overlap in the area of any single prospect.

No potential traps are recognized in available seismic interpretations (Tetra Tech, 1981: Map KJ) of Play 9. Most potential traps are probably associated with sandstone bodies isolated within shales. Alpine field probably represents this type of trap (Gingrich, Knock, and Masters, 2001). Seismic amplitude mapping within a 924-mi^2 3-D seismic survey in Play 8 in the Northeast NPR-A Planning Area has identified anomalies that may correspond to porous or hydrocarbon-saturated sandstones. The results of this mapping were extrapolated to the entire area of Play 9 to estimate the numbers and areal sizes of prospects.

Petroleum charging of Play 9 was probably from thermally mature Shublik and Kingak Formation shales within and south of the play area. The Pebble Shale may form a source for oil in Kuparuk-equivalent sandstones in southern parts of Play 9. The Shublik Formation is viewed generally as the dominant source for the low (20° to 28° API) gravity Prudhoe Bay geochemical family of oils (Claypool and Magoon, 1985:p. 49). The high (40° API) gravity, low-sulfur oil at Alpine field is probably derived from the Kingak Formation (Masterson, 2001). Play 9 passes into a gas-only Play 10 to the south and a gas-dominated Play 18 on the west. Regionally, the Inigok and Topogoruk wells have penetrated Play 9, encountering no pooled hydrocarbons.

Play 10. Beaufortian-Gas Belt (UBWA1000)

Play 10 covers 4,100 mi^2 in the Northeast and Northwest NPR-A (total area of Play 10 within NPR-A is 5,670 mi) and lies between drilling depths of 7,000 and 26,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 10 is shown in Map 102. The Beaufortian sequence ranges from approximately 3,200 ft to 4,300 ft thick within the play area (Bird, 1988c:figs. 16.15 and 16.16). The Beaufortian sequence consists mostly of Cretaceous-age’ Kingak Formation shales and sandstones deposited on a south-facing shelf, slope, and deep basin plain (Bird and Molenaar, 1992: p. 368, fig. 5). Play 10 straddles a shelf edge mapped by Bird (1988c:fig. 16.15) along a zone of abrupt thinning of the Kingak Formation (observed in seismic data).

All of the Play 10 rocks are deeply buried and are expected to offer only modest reservoir porosities at best. The only anticipated resource is natural gas derived from thermally over-mature and gas-generative Shublik, Kingak, and Pebble Shale Formations. No wells have penetrated play 10. However, Tunalik well, just north of the play area in the west, encountered very strong gas shows in a Kuparuk(?)-equivalent Cretaceous sandstone at 12,500 ft within the Beaufortian sequence. Nine wireline formation tests were attempted in this interval, but all failed to sample pressures or formation fluids.

Play 11. Brookian Turbidites-Arctic Platform-East (UBWA1100)

Play 11 covers 9,100 mi^2 and lies between drilling depths of 2,000 and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 11 is shown in Map 103. The Torok Formation, which contains the turbidite sandstone reservoir objectives, ranges from 2,000 to 10,000 ft thick within the play area (Bird, 1988c: fig. 16.17), but sandstones are generally confined to channeled submarine fan systems in the lowermost 2,000 ft. The turbiditic sandstones were deposited in slope or basin-floor settings near the toe of the east-prograding Nanushuk-Torok delta system[3] that ultimately filled the Colville basin. To the north, sandstones are generally sparse and thin, but preserve modest porosities. To the south, near the axis of the Colville basin, sandstones are abundant and relatively thick, but generally lack porosity because of deep burial. McMillen (1991) recognizes sand-rich low-stand fans and shaly, high-stand fans within the Torok Formation. Identification of the sand-rich fans may be the key to exploration success in Play 11. The lack of pore-system continuity, and quality are the chief antagonists to the success of this play.

North-trending seismic anomalies in the area of the Fish Creek paleo-slump feature (located in Map 103) were originally interpreted as submarine canyons incised into the Torok Formation and older units, with intervening bands mapped as erosional relicts. This interpretation suggests that these submarine canyons could have locally captured substantial thickness of turbidite sandstones, forming oil traps. However, three wells, the Atigaru Point, South Harrison Bay, and West Fish Creek wells, actually penetrated the supposed submarine canyons and did not encounter any unusual thickness of turbiditic sandstones. In fact, Weimer (1987) and Homza (2001) reject the "submarine canyon" hypothesis altogether, interpreting the seismic anomalies as slope-failure slides of blocks of (Torok) slope sediments and Pebble Shale, draped by younger pelagic slope sediments offering negligible reservoir potential. However, there is potential for upslope ponding of turbiditic sandstones behind slide blocks. Three potential upslope "ponds" were penetrated by the Atigaru Point, South Harrison Bay, and West Fish Creek wells, encountering very sparse sandstone with oil and gas shows in the lower Torok Formation. The concept of slump-ponded sandstones should not be discounted as traps because such features are part of the trap mechanism at the Tarn (50 million barrels [MMbbl] of oil) and Meltwater (52 MMbbl of oil) fields east of the NPR-A (Hastings, 2001). Although Fish Creek slide is a very prominent and large example of slumps within the Torok Formation, such features are widely observed outside Fish Creek slide. In some cases, ponded sediment upslope from slump blocks is associated with seismic amplitude anomalies suggesting the presence of porous or hydrocarbon-saturated sandstones.

In the NPR-A, turbiditic sandstones within the Torok Formation are mostly Early Cretaceous in age (Middle Albian to Cenomanian; Huffman, Ahlbrandt, and Bartsch-Winkler, 1988:fig. 13.11). Comparable turbiditic sandstones to the east that form the reservoirs at Tarn (50 MMbbl of oil) and Meltwater (52 MMbbl of oil) discoveries are mostly part of the Canning Formation (terminology of Molenaar, Bird, and Collett, 1986) of Late Cretaceous age. The younger (Canning Formation) Brookian turbidite sandstones east of the NPR-A are generally better prospects for petroleum because sedimentary recycling has removed many of the ductile (soft) particles that cause the rapid porosity loss with burial observed in the older Brookian turbidites to the west, within the NPR-A.

Seismic data reveal some anticlinal structures draped over the Lower Cretaceous unconformity along the Fish Creek platform that could form potential traps if sandstones are present in the basal Torok Formation immediately above the unconformity. However, most traps are probably stratigraphic, consisting of turbiditic sandstones filling incised slope channels, mounded submarine fans, and turbiditic sandstones ponded upslope of slumps. Such sandstones are isolated (forming sealed volumes) by draped pelagic shales and form potential traps. The MMS and BLM used 3-D seismic data in a 308-mi^2 survey area in the Northeast NPR-A Planning Area to identify these types of stratigraphic traps. Seismic amplitude mapping on chronostratigraphic (time-correlative) surfaces within the Torok Formation and the overlying Nanushuk Group reveals numerous anomalies that may represent porous or hydrocarbon-saturated sandstones. The survey area represents only 3 percent of the 9,100-mi^2 play area. However, the entire play area is believed to share the same geologic context and characteristics of the much smaller area in the 3-D seismic survey. The results of the seismic amplitude mapping for the Torok Formation were extrapolated over the entire play area to estimate the numbers and size range of prospects. This extrapolation yielded an increase in the number of prospects (12-fold increase in prospect density or numbers of prospects per unit area) and a decrease in the size of the prospects (a 50% decrease in the mean prospect size) relative to the 1997 assessment of Play 11 for the Northeast NPR-A Planning Area. The net effect of the 3-D seismic data for prospect forecasting was a substantial increase in the estimates for oil and gas potential within Play 11.

Petroleum charging of Play 11 was probably from the thermally mature Shublik, Kingak, and Pebble Shale Formations that directly underlie the Brookian turbidite reservoirs within and south of the play area. Torok shales are also a charging source, chiefly for gas. At least 28 wells have penetrated Play 11 within the NPR-A. Small amounts of gas or oil were recovered from Brookian turbiditic sandstones in the South Harrison Bay, South Simpson, Drew Point, and Ikpikpuk wells.

Play 12. Brookian Turbidites-Gas Belt (UBWA1200)

Play 12 covers 7,900 mi² (total area within NPR-A, 18,984 mi²) and lies between drilling depths of 8,000 and 22,000 ft within the Northeast and Northwest NPR-A Planning Areas. Play 12 extends south beneath Play 23 to the front of the Brooks Range but is obscured beneath the complex structures of overlying rocks in the southern part of the play area. The area of Play 12 is shown in Map 103. The Torok Formation, containing the turbidite sandstone reservoir objective, ranges from 5,000 to 15,000 ft thick within the play area (Bird, 1988c: fig. 16.17). However, sandstones are generally confined to the lowermost 2,000 to 5,000 ft, with the greater thickness encountered in southern parts of the play where the Fortress Mountain Formation is present beneath the Torok Formation. The turbiditic sandstones were deposited in slope or basin-floor settings near the toe of the east-prograding Nanushuk-Torok delta system that ultimately filled the Colville basin. Extensive destruction of pore systems is expected because of compaction in response to deep burial. However, overpressure or secondary leaching may have acted to preserve or restore porosity in some areas.

To estimate the numbers of structural traps in the deformed, southern part of Play 12, it was assumed that structures would mimic those mapped in seismic data in Play 22, which occurs in overlying thrust plates. Structural relations of deformed-belt plays in the southern NPR-A are illustrated in the cross-section of Figure App-01. Additional traps are probably stratigraphic, consisting of bodies of turbiditic sandstones isolated within shales. Such prospects are accounted in the assessment as "unidentified" prospects. The geologic context of Play 12 is quite different from that of the area of 3-D seismic surveys in the Northeast NPR-A Planning Area and the results of that mapping were not extrapolated to Play 12.

The only anticipated resource in Play 12 is natural gas derived from the Shublik, Kingak, Pebble Shale, and Torok Formations. Play 12 has not been penetrated by any wells. Tunalik well, just north of the play area, found strong gas shows in sandstones in the lower part of the Torok Formation (Magoon and others, 1988:pl. 19.2).

Play 13. Brookian Topset-Arctic Platform-East (UBWA1300)

Play 13 covers 8,600 mi² and lies between drilling depths of 1,000 ft (everywhere exposed at land surface) and 7,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 13 is shown in Map 104. Across most of NPR-A, the Brookian "topset" sequence consists of the mostly Lower Cretaceous (Middle Albian to Cenomanian) Nanushuk Group (Figure III-01). Upper Cretaceous "topset" sandstones of the Colville Group are present in the eastern NPR-A (distribution shown in Map 104). The reservoir objectives are fluvial, deltaic, and shelf rocks deposited as distributary channel fill, distributary-mouth bars, and offshore bars. These sandstones were deposited near the paleo-shoreline(s) of the east-prograding delta system that simultaneously deposited the turbiditic sandstones of Plays 11, 12, and 19 in deep water on the delta slope(s) or on the basin floor(s) to the east. A belt of sandstone-rich Nanushuk Group, dominated hypothetically by "coastal-barrier" sandstones (reworked by shoreline processes, i.e., wave swash) passes from the Ikpikpuk well southeast to the Umiat area (Huffman, Ahlbrandt, and Bartsch-Winkler, 1988:fig. 13.4). This sandstone-rich belt may offer reservoir qualities superior to the more typical Nanushuk sandstones found elsewhere.

Within the play area, the Nanushuk Group ranges from 0 to 3,500 ft thick. The Nanushuk Group is absent in the Barrow area because of local uplift and erosion (Map 104). From the Ikpikpuk River to the eastern boundary of NPR-A, the Nanushuk Group is overlain by as much as 5,000 ft of Upper Cretaceous prodelta shales and fluvial-deltaic sandstones of the Colville Group (Figure III-01). The distribution of the Colville Group in eastern NPR-A is shown in Map 104. The Colville Group sandstones could form potential petroleum reservoirs in eastern NPR-A, but are generally quite shallow and extend directly to the land surface on the west. Sandstones within the Nanushuk Group in Play 13 have not been buried deeply, so they often preserve modest porosities. Fine grain size and clay contents offer the greatest challenges to reservoir quality (Huffman, Ahlbrandt, and Bartsch-Winkler, 1988).

The Brookian topset sequence is unstructured in the play area (Tetra Tech, 1981:Maps K1-K4) and any traps probably consist of discontinuous sandstone bodies isolated within shales. Play concepts for such traps might include shelf-edge, low-stand wedges or channel complexes isolated beneath shales that onlap a younger flooding surface. For example, an incised channel near the paleo-shelf edge that was ultimately filled with sandstone forms the trap for the Tabasco oil pool (30 MMbbl of oil) in the Kuparuk unit (Map 104) (Konkler et al., 1995). A 308-mi² 3-D seismic survey in the northeastern NPR-A helped identify the sizes and numbers of stratigraphic prospects in the Brookian topset sequence on the Arctic platform. Seismic amplitude mapping on chronostratigraphic surfaces within the Nanushuk Group and underlying Torok Formation revealed numerous anomalies that may represent porous or hydrocarbon-saturated sandstones. The survey area represents only 4 percent of the 8,600 mi² area of Play 13. However, all of Play 13 is believed to share the geological attributes of the 3-D seismic survey area. The results of the seismic amplitude anomaly mapping were extrapolated to the entire play area in order to estimate the numbers and size range of prospects. This extrapolation yielded a 12-fold increase in prospect density but a two-fold decrease in mean prospect area relative to the 1997 assessment of Play 13 in the Northeast NPR-A Planning Area. The net effect of this application of 3-D seismic mapping is a substantial increase in the estimates of oil and gas potential for Play 13.

It is likely that petroleum charging of Play 13 was mostly from the thermally mature, gas-prone Torok shales filling the lower parts of the Colville basin. Shales of the Shublik, Kingak, and Pebble Shale Formations underlie Colville basin and are potential sources for oil. However, several thousand feet of overpressured Torok shales intervene between the "topset" reservoirs and the deeper, thermally mature oil sources. Denial of access to migrating oil by this shale barrier (diverted north beneath the barrier toward Barrow Arch) may be the chief threat to success of prospects within this play. However, Shublik-derived oil was found in Nanushuk sandstones at Fish Creek and Pebble Shale-derived oil was found at Simpson field. The Fish Creek field was discovered through drilling at surface seeps , and the quantity of oil present is unknown. At Simpson field (12 MMbbl of oil, also discovered by drilling on seeps), oil-charged Nanushuk sandstones are truncated and sealed at the wall of the shale-filled Simpson paleocanyon (Map 104). At least 28 wells have penetrated Play 13 in the NPR-A. Two oil fields (Simpson and Fish Creek) were discovered and minor amounts of gas were tested at the East Topogoruk well.

Play 14. Brookian Foldbelt (UBWA1400)

Play 14 covers 8,400 mi² (total area within NPR-A, 17,110 mi²) and lies between drilling depths of 1,000 (everywhere exposed at land surface) and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 14 is shown in Map 104. The play area extends from the southern edge of the Nanushuk topset outcrop belt to unfolded Brookian topset rocks on the north. Reservoir objectives within the Brookian Foldbelt play are sandstones of the principally Lower Cretaceous (Middle Albian to Cenomanian) Nanushuk Group. However, some sandstones that occur sparsely within upper parts of the Torok Formation share the same shallow fold structures involving topset strata and have tested gas at some wells. These Torok Formation sandstones are

($4.27/Mcf), 5,697 MMbbl of oil and 15.830 Tcf of gas are economically viable, representing 63% (oil) and 42% (gas) of the mean geologic resource base.

Commodity prices have a major influence on economically recoverable volumes. Higher commodity prices invariably lead to higher resource recovery. Because the resource estimates will be used primarily for lease sale planning and environmental impact analysis, some reasonable price brackets were selected. With regard to probability levels, the mean resource case is the most relevant because it represents the average statistical outcome of the economic analysis. In economic terms, the risked mean case is often referred to as the "expected value." Another advantage to using the risked mean is that components (individual plays, sub-areas, and other items) can be added and subtracted without violating statistical principles.

Two price levels were used to bracket economically recoverable oil and gas volumes. The $18.00/bbl price included in Play 14 because they may represent minor regressions in the Nanushuk-Torok delta system and they share the same shallow structures as the overlying Nanushuk Group.

The Nanushuk Group in Play 14 ranges from 1,000 to 10,000 ft thick (Bird, 1988c:fig. 16.18). The Nanushuk Group along the eastern boundary of NPR-A is overlain by up to 3,500 ft of Upper Cretaceous prodelta shales and fluvial-deltaic sandstones of the Colville Group that are also folded (Bird, 1988c:figs. 16.19, 16.20). The distribution of the Colville Group (identified as "Upper Cretaceous") is shown in Map 104. The Colville Group sandstones form potential petroleum reservoirs in the foldbelt in the eastern NPR-A, but are generally quite shallow and extend along fold axes directly to the land surface on the west. However, some Colville Group sandstones in the Gubik anticline are charged with gas (tested 2,060 Mcf of gas per day at Gubik No. 1; Molenaar, Bird, and Collett, 1986). Stratigraphic barriers providing western permeability seals on the east-plunging folds are required to complete the traps on some anticlines in these folded Upper Cretaceous rocks. Sandstones within the Nanushuk Group in Play 14 have been buried more deeply (and uplifted) than those in the unstructured area to the north in Play 13, but are overall coarser-grained and retain modest porosities. Clay contents and compaction of soft particles in sandstones are the greatest challenges to survival of reservoir pore systems (Huffman, Ahlbrandt, and Bartsch-Winkler, 1988: fig. 13.5).

Traps are mostly large anticlines reaching 100,000 acres in closure area that formed over deeper thrust faults. Prospect areas and numbers were estimated from existing publicly-available seismic structure maps by Tetra Tech (1981:Maps K1-K4). In the southern third of the play area, anticlines are breached and the entire column of Nanushuk Group sandstones extends directly to the land surface. Any hydrocarbons once trapped in these anticlines would have been lost when they were breached by erosion. The structural style of the folds in Play 14 is illustrated in the cross section of Figure App-01.

Petroleum charging of Play 14 was probably from thermally mature Torok Formation shales, primarily a source for gas. The Pebble Shale, Kingak Formation, and Shublik Formation beneath Colville basin might form sources for oil. However, several thousands of feet of overpressured Torok shales typically intervene between Nanushuk and Colville Group reservoirs and the Pebble Shale, Kingak, and Shublik oil sources below the floor of Colville basin. Denial of access to migrating oil by this shale barrier may be a significant problem for many prospects in this play, although nearly a billion barrels of oil somehow made its way--perhaps along thrust faults passing from source to reservoir--to Umiat field (70 MMbbl of oil) in the eastern part of the play area (Map 104). Small gas fields in the foldbelt play have also been discovered at Meade, Square Lake, Wolf Creek, East Umiat (east of NPR-A), and Gubik fields. Small amounts of gas were tested from foldbelt structures at Oumalik, Titaluk, Knifeblade, Koluktak, Eagle Creek, and Tungak Creek (Map 104). Small amounts of gas (rate not measured) were tested from turbiditic sandstones at Akulik well, west of the NPR-A. Gas was also tested from sandstones of the Torok Formation at 2,652 ft (rate too small to measure) and at 5,366 ft (6.7 MMcf of gas per day with minor high-gravity oil) in the Seabee well (Bird, 1988b:p. 330, table 15.5: Magoon and Claypool, 1988:p. 526, table 21.1).

Play 15. Sag River/Shublik-Barrow Arch-West (UBWA1500)

Play 15 covers 600 mi² and lies at drilling depths between 2,000 and 7,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 15 is shown in Map 101. The primary reservoir objectives are the sandstones of the Sag River Formation and/or the carbonates of the Shublik Formation. The Sadlerochit Group is absent owing to onlap at the south edge of the play area (Bird, 1988c:fig. 16.12). Potential traps are stratigraphic wedges produced by truncation of reservoir sandstones, and subtle anticlinal structures in the Barrow area. It is likely that petroleum charging for this play was mostly from Pebble Shale, Kingak, and Shublik Formations that are now deeply buried, thermally over-mature, and gas-generative. The play may have been additionally charged by petroleum migrating northwest along Barrow Arch from the east, or, in the northernmost parts of the play, by petroleum migrating south from areas of deep burial to the north, offshore from the Beaufort shelf. Play 15 was penetrated by most of the development wells for the Barrow gas fields. Minor amounts (to 2.6 barrels) of oil (high-sulfur, low-gravity, "Barrow-Prudhoe" type) and gas (to 800 Mcf of gas per day) were tested from the Sag

Overall Oil and Gas Resources Proportioned to the Areas Assessed. The 2002 USGS assessment (Bird and Houseknecht, 2002a) estimated that the entire Federal part of NPR-A (excludes State of Alaska waters along the coast and Native lands within NPR-A) may contain mean undiscovered resources of 9.3 billion barrels (Bbbl) of oil and 59.7 trillion cubic feet (Tcf) of non-associated (no oil present) natural gas. To obtain the total resource endowment, add 1.37 Bbbl of natural gas liquids (NGL) and 10.3 Tcf of associated gas (solution and gas cap gas), reported separately as part of the USGS assessment by Schuenemeyer (2003). Total undiscovered resources of 10.67 Bbbl oil (crude oil plus NGL) and 70.0 Tcf gas (non-associated plus associated) were obtained for the 2002 USGS assessment of the entire Federal part of NPR-A.

The 2002 MMS-BLM assessment (this study) estimated that the combined Northwest and Northeast Planning Areas contain mean undiscovered resources of 9.101 Bbbl oil (crude oil plus NGL) and 37.309 Tcf gas (non-associated plus associated). Thus, the outward volumetric differences between the two groups amount to

River Formation at three of these wells.

Play 16. Sadlerochit-Arctic Platform-West (UBWA1600)

Play 16 covers 1,800 mi² and lies at drilling depths between 7,000 and 13,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 16 is shown in Map 101. The primary reservoir objective is the Triassic Ivishak sandstone of the Sadlerochit Group. Sandstones of the Sag River Formation may also contain petroleum. The Ivishak sandstone ranges from 0 to 150 ft thick within the play area and average porosities range from 0 to 15%. This reflects a more marine and shaly facies than prevailed in Play 6 (mapped porosities of 7 to 15%) in the Northeast NPR-A Planning Area along the Barrow Arch. A history of deeper burial for Play 16 also contributes to its relatively diminished reservoir properties.

Potential traps are mostly small stratigraphic closures related to onlap of the structural high at Barrow. A few subtle anticlinal structures draped over basement are also present (Tetra Tech, 1981:Map TPS). Petroleum charging for this play was probably from the thermally over-mature and gas-generative Shublik, Kingak, and Pebble Shale Formations deeply buried on the south. The exploration experience in this area has shown that Play 16 is gas prone (as are all other plays west of Meade Arch), although sparse oil shows suggest that oil accumulations cannot be ruled out. At Meade Arch, Play 16 passes eastward into the correlative but more oil-prone Play 7. At its southern limit, Play 16 passes into the Ellesmerian (All) Gas Belt play (3). The Peard, Kugrua, and Brontosaurus wells penetrated Play 16. Kugrua well penetrated the Sadlerochit Group in a shale facies. No hydrocarbons were tested from the Sadlerochit Group or other Play 16 units at these wells, although a trace of dead oil (asphaltic material) was noted (mud log) in cherty Ivishak conglomerates at Brontosaurus.

Play 17. Beaufortian-Barrow Arch-West (UBWA1700)

Play 17 covers 1,500 mi² and lies between drilling depths of 1,500 and 8,500 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 17 is shown in Map 102. Play 17 lies west of Meade Arch and includes the gas fields under production near Barrow, Alaska. The Beaufortian sequence ranges from 400 to 1,700 ft thick within the area of Play 17 (Bird, 1988c:figs. 16.15, 16.16). Reservoir objectives include the Cretaceous Walakpa' sandstone, the Jurassic Simpson sandstone (distribution mapped by Bird, 1988a:fig. 4.13), and the Jurassic Barrow sandstone, the latter occurring in the lower part of the Kingak Formation (Figure III-01). The Walakpa sandstone ranges from 5 to 40 ft thick and is generally thickest in southern parts of the play area. At Walakpa gas field, the sandstone averages 24 ft (net pay) thick, with an average porosity of 24% and an average permeability of 187 millidarcys (md) (State of Alaska, Oil and Gas Conservation Commission, 1994:p. 219). The Simpson sandstone, ranging from 110 to 180 ft thick, was penetrated by five wells (Topogoruk, South Simpson, South Meade, Peard, and Kugrua). The Barrow sandstone ranges from 0 to 130 ft thick and is typically 110 ft thick in the area of the Barrow gas fields. The average porosity of the Barrow sandstones is about 20%, and permeability averages 25 md (Lantz, 1981:p. 198). Play 17 may contain the Jurassic sandstones ("Alpine," "Nuiqsut," and "Nechelik" sandstones of Kornbrath et al., 1997) that were recently discovered to be productive at the Alpine field and in the Colville delta area adjacent to northeastern NPR-A. Sandstone in the Kuyunak well may be correlative to the Kuparuk "C" sandstone but Houseknecht (2001) correlates it to the Alpine sandstone. The entire Kingak Formation is absent from an area along the northern coast at Barrow because of erosional truncation at the Lower Cretaceous unconformity (shown in Map 102).

The Barrow-area gas fields are unique structural traps on the flank of Avak structure, a semi-circular feature interpreted to represent a Cretaceous-age meteorite impact crater (Kirschner and others, 1991). Elsewhere in Play 17, potential traps that are easily recognized in seismic data are stratigraphic wedges created by erosional truncations at the Lower Cretaceous unconformity. Additional traps are probably associated with sandstone bodies isolated depositionally within shales. For example, the Walakpa field occurs within Walakpa sandstones apparently laterally sealed within shales. Seismic amplitude mapping within a 924-mi² 3-D seismic survey from

500 MMbbl). The next largest oil pool in the same play contains 441 MMbbl. The 2002 USGS assessment of NPR-A does not report specific pool sizes but identifies one oil pool in the size range of 512 to 1,024 MMbbl, associated with a Beaufortian play correlative to the Alpine oil field (Bird and Houseknecht, 2002a:figs. 5, 6). Both assessments forecast one oil pool in the size range of 512 to 1,024 MMbbl as the largest in their respective assessment areas. In both assessments, the largest pools are associated with Beaufortian plays.

In the 2002 MMS-BLM assessment of the combined Northwest and Northeast Planning Areas, the largest hypothetical undiscovered gas pool is forecast to contain 2.861 Tcf gas (mean size, with a possible range from 0.279 to 8.912 Tcf). This pool is associated with MMS-BLM Beaufortian play 8. The 2002 USGS assessment identified approximately 8 hypothetical undiscovered gas pools in the size range from 1.536 to 12.288 Tcf gas (Bird and Houseknecht, 2002a:fig. 5). The USGS assessment forecasts more gas pools of the largest size classes correlative Play 8 has identified anomalies that may correspond to porous or hydrocarbon-saturated sandstones. The results of this mapping were extrapolated to the entire area of Play 17 (1,500 mi^2) in order to estimate the numbers and size range of prospects for Play 17.

Current interpretations suggest that petroleum charging for Play 17 was probably from thermally over-mature and gas-generative Shublik, Kingak, and Pebble Shale Formations that are deeply buried on the south. The exploration experience shows that the area is primarily a gas province. However, 2.6 bbl of oil were recovered from the Sag River Formation (Play 15) beneath the Barrow-area gas fields, and oil has been recovered from the Pebble Shale or Kingak Formation in other wells in the Barrow area (Magoon and Claypool, 1988). The oils from the Barrow area appear to fall into one of two groups: 1) "Pradhoe-type" high-sulfur, low-gravity (16° to 24° API) oils pooled in the Sag River sandstone (Play 16), or 2) "Pebble Shale-type" low-sulfur, high-gravity (30° to 41° API) oils pooled in the Pebble Shale or Kingak Formation (Magoon and Claypool, 1988: p. 528, table 21.2). Because the entire geologic column above basement is thermally immature at Barrow (Bird and Molenaar, 1992), both oil groups probably migrated to the Barrow structures from thermally mature sources to the north and/or south, perhaps before gas later invaded the structures.

Original recoverable reserves for the two gas fields near Barrow are 26 billion cubic feet (Bcf) at South Barrow field, and 13 Bcf at East Barrow field (Lantz, 1981; State of Alaska, Dept. of Natural Resources, 2000). Production at the Barrow fields is primarily from the Barrow sandstones, but a Walakpa-equivalent sandstone has also produced at some field wells. Basement rocks (argillite) tested gas at the South Barrow No. 4 well (Bird, 1988b:p. 326, table 15.5). The Walakpa gas field (12 mi south of the Barrow fields) is estimated to contain 32 to 180 Bcf in ultimate gas reserves in the Walakpa sandstone (State of Alaska, Dept. of Natural Resources, 2000; Kornbrath et al., 1997). The Peard, Brontosaurus, and Kuyunak wells penetrated Play 17. Gas shows were noted in the Beaufortian sequence at Peard. Pooled gas appears (cased-hole logs) to be present in the Walakpa sandstone penetrated at the Brontosaurus well.

Play 18. Beaufortian-Arctic Platform-West (UBWA1800)

Play 18 covers 3,000 mi^2 and lies between drilling depths of 2,000 and 17,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 18 is shown in Map 102. The Beaufortian sequence ranges from 1,400 to 3,800 ft thick within the play area (Bird, 1988c: figs. 16.15, 16.16). Reservoir objectives include the Lower Cretaceous sandstones at Tunalik well (equivalent to Kuparuk(?) sandstones) and possibly some Jurassic sandstones (equivalent to the "Alpine," "Nuiqsut," and "Nechelik" sandstones of Kornbrath et al., 1997). The Jurassic Simpson and Barrow sandstones that are found to the north in Play 17 do not extend south into the Play 18 area (Bird, 1988a:fig. 4.14).

The Upper Jurassic sandstones encountered near Alpine field have not been observed in wells in western NPR-A, but they could be present in some of the sparsely drilled eastern parts of Play 18. At Tunalik well, a sandstone possibly equivalent to the Kuparuk sandstone is over 500 ft thick, with porosities averaging 11% (Sherwood and others, 1998:pl. 13.4).

One potential trap recognized in available seismic interpretations is a low-amplitude anticline (Tetra Tech, 1981:Map KJ). Additional traps are probably associated with sandstone bodies isolated within shales. Seismic amplitude mapping within a 924-mi^2 3-D seismic survey in Play 8 in the northeastern NPR-A has identified anomalies that may correspond to porous or hydrocarbon-saturated sandstones. To estimate the numbers and areal sizes of prospects, the results of this mapping were extrapolated to the entire area of Play 18 (3,000 mi^2).

Petroleum charging of Play 18 was probably from thermally over-mature (gas-generative) Shublik, Kingak, and Pebble Shale formations within and south of the play area. The exploration experience to date suggests that Play 18 is gas-prone. The Kugrua, Tunalik, and South Meade wells penetrated Play 18. The Tunalik well apparently

[6] Uppermost sandstone in Kuparuk field (Carman and Hardwick, 1983), but here occurring as an unconformity sandstone locally mantling the Lower Cretaceous unconformity.

[7] Generally entirely Jurassic in age to north in correlative Arctic Platform (Plays 9 and 18) and Barrow arch (Plays 8 and 17) plays.

[8] Specifically, the Kurupa-Umiat lobe of Huffman, Ahlbrandt, and Bartsch-Winkler (1988:fig. 13.11).

encountered pooled gas in Kuparuk-equivalent sandstones between 12,508 and 12,603 ft, but nine wireline tests failed to sample formation fluids. Play 18 passes into a correlative gas-only play (Play 10) to the south and a correlative oil-prone play (Play 9) on the east.

Play 19. Brookian Turbidites-Arctic Platform-West (UBWA1900)

Play 19 covers 5,500 mi² and lies between drilling depths of 1,000 (i.e., land surface) and 16,000 ft within the Northwest and Northeast NPR-A Planning Areas. The area of Play 19 is shown in Map 103. Play 19 lies west of Meade Arch and south of the Chukchi Sea coast. The Torok Formation, which contains the turbidite sandstone reservoir objectives, ranges from 3,000 to 9,000 ft thick within the play area (Bird, 1988c:fig. 16.17), but sandstones are generally confined to the lowermost 2,000 ft. In the western NPR-A, turbiditic sandstones within the Torok Formation are mostly Early Cretaceous (Middle Albian to Cenomanian; Huffman, Ahlbrandt, and Bartsch-Winkler, 1988:fig. 13.11). The turbiditic sandstones were deposited in slope or basin-floor settings near the toe of the east-prograding Nanushuk-Torok delta system[10] that filled the Colville basin. To the north, sandstones are generally sparse and thin, but preserve modest porosities. To the south, sandstones are abundant and relatively thick, however they generally lack porosity because of deep burial. Reservoir presence, continuity, and pore-system quality are the chief antagonists to the success of this play. McMillen (1991) recognizes sand-rich, low-stand fans and sand-poor (shaly), high-stand fans within the Torok Formation. Identification of the sand-rich fans via 3-D seismic data may be the key to exploration success in Play 19.

Older, conventional seismic data reveal two large anticlinal features at the base of the sequence (Lower Cretaceous unconformity) south of Barrow (Tetra-Tech, 1981:Map KJ), and turbiditic sandstones at the base of the sequence may drape this feature. Most traps are probably stratigraphic, consisting of bodies of turbiditic sandstones isolated within shales that are difficult to identify in conventional seismic data. Seismic amplitude mapping within a 308-mi² 3-D seismic survey in northeastern NPR-A (in correlative Play 11) has identified anomalies on chronostratigraphic surfaces within the Torok Formation. These anomalies may correspond to porous or hydrocarbon-saturated sandstones. The results of this mapping were extrapolated to the entire area of Play 19 (5,500 mi²) in order to estimate the numbers and size range of prospects.

Petroleum charging of Play 19 was probably from the thermally over-mature (gas-generative) Shublik, Kingak, and Pebble Shale Formations that directly underlie the Brookian turbidite reservoirs within and south of the play area. Torok shales also might constitute a source, chiefly for gas. The exploration experience has shown that Play 19 is gas-prone. Twenty-eight wells, mostly in the Barrow gas fields (23 wells), have penetrated Play 19. No turbiditic sandstones were tested, although gas shows were associated with these sandstones in the Peard, Tunalik, and Brontosaurus wells.

Play 20. Brookian Topset-Arctic Platform-West (UBWA2000)

Play 20 covers 6,400 mi² (total area within NPR-A, 6,726 mi²) and lies between drilling depths of 1,000 (i.e., land surface) and 7,000 ft within NPR-A. The area of Play 20 is shown in Map 104. Across Play 20, the Brookian "topset" sequence consists of the mostly Lower Cretaceous (Middle Albian to Cenomanian) Nanushuk Group. Upper Cretaceous "topset" sandstones of the Colville Group are not present. The reservoir objectives are deltaic and fluvial rocks deposited as distributary-mouth bars and shorelines of the east-prograding delta system that simultaneously deposited the turbiditic sandstones of Plays 11, 12, and 19 in deeper waters to the east. Within the play area, the Nanushuk Group ranges from 0 to 8,000 ft thick. Sandstones within the Nanushuk Group in Play 20 have not been buried deeply, so they often preserve modest porosities, with fine grain size and clay contents offering the greatest challenges to reservoir quality (Huffman, Ahlbrandt, and Bartsch-Winkler, 1988). Petroleum charging of Play 20 was probably from the Torok shales that fill the lower parts of Colville basin. Potential sources include thermally over-mature and gas-generative shales of the Shublik, Kingak, and Pebble Shale Formations underlying the western Colville basin. However, the shallow sandstones forming the reservoir objectives in Play 20 are separated from these deep petroleum sources by as much as 5,000 ft of overpressured Torok shales. Denial of access to migrating petroleum by this shale barrier (migrating oil or gas probably was diverted north beneath the shale barrier toward Barrow Arch) may be the chief threat to success of prospects within this play. Minor oil shows were found in Nanushuk sandstones at Tunalik and Peard wells, suggesting some transmissibility of oil through the underlying Torok shales.

The Brookian topset sequence is virtually unstructured in the play area and mapping with conventional seismic data (Tetra Tech, 1981:Map K1-K4) failed to identify any traps. Traps probably consist of discontinuous sandstone bodies isolated within shales. Play concepts for such traps might include low-stand wedges or prograding complexes high on slopes, or traps that are isolated beneath shales that onlap a younger flooding surface. Seismic amplitude mapping from a 308-mi^2 3-D seismic survey in the northeastern NPR-A (in correlative Play 13) has identified anomalies on chronostratigraphic surfaces within the Nanushuk Group. These amplitude anomalies may correspond to porous or hydrocarbon-saturated sandstones. To estimate the numbers and sizes of prospects, the results of this mapping were extrapolated to the entire area of Play 20 (6,400 mi^2).

Seven wells penetrated Play 20. Exploration drilling to deeper horizons encountered mostly gas. This suggests that the play is generally gas-prone. Minor oil shows were noted in Nanushuk Group sandstones at Tunalik and Peard wells. None of the seven wells encountered pooled hydrocarbons.

Play 21. Endicott/Lisburne-Thrust Belt (UBWA2100)

Play 21 covers 6,300 mi^2 and ranges in potential drilling depths between 1,000 ft (i.e., land surface) and 38,000 ft within the NPR-A, but lies entirely south of the Northwest and Northeast NPR-A Planning Areas. The area of Play 21 is shown in Map 99. Play 21 involves complex structures created by thrust faults rising from beneath the Brooks Range. The structural architecture of Play 21 is illustrated in the cross section of Figure App-01. Play 21 was not quantitatively assessed and is not described further.

Play 22. Beaufortian-Deep Detached Foldbelt (UBWA2200)

Play 22 covers an area of 4,100 mi^2 as shown in Map 102 (total within NPR-A, 13,709 mi^2). The play is generally deeply buried, ranging from 12,000 ft to 26,000 ft in drilling depths. However, Beaufortian-equivalent rocks also occur in the thrust stack at shallow depths beneath Cretaceous cover strata in the thrust stack north of the Brooks Range front. These rocks are locally exposed in places like the Surprise Creek locality described by Mull (1997) west of the NPR-A. While Beaufortian-equivalent rocks in the thrust stack cannot be mapped in seismic data, farther north, and at much greater depths, Beaufortian rocks can be recognized in seismic records. These rocks are involved in a belt of detached folds and thrust faults extending to 60 mi north of the range-front of the Brooks Range. In regional seismic records, the complex appears to be enclosed within a low-angle duplex or triangle zone tapering northward beneath roof thrust(s) in the lower part of the Brookian sequence or the upper part of the Beaufortian sequence. A schematic interpretation of the structure of Play 22 is shown in Figure App-01.

Available seismic structure maps (Tetra Tech, 1981:Map KJ) illustrate that Play 22 lies mostly down dip from the Beaufortian gas belt (Play 10), and therefore, would offer potential for gas only. Because of the complex burial history and widespread extreme thermal maturity, the majority of potential reservoir rocks in Play 22 probably offer only small amounts of relict intergranular porosity, or porosity related to fractures. The Beaufortian sequence across most of Play 22 is primarily in a basinal (shale) facies, but some shelf sandstones may be present within northern parts of the play area (shelf-edge mapped by Bird, 1988c:fig. 16.15). Most traps in Play 22 are fault-bend folds with anticlinal closure or fault-truncation closure. Stratigraphic traps, consisting of bodies of sandstone isolated within shales, are probably also present.

Beaufortian(?) sandstones in Play 22 were penetrated at the 13,200- to 13,500-ft (measured depth) interval in the Seabee well in the southeast NPR-A and below 15,670 ft in the Tulugak well east of the NPR-A (Map 102). A Beaufortian sandstone at the Seabee well with vitrinite reflectance of 1.99% was associated with strong gas shows and flow into the well during drilling. The Tulugak well tested gas at 936 Mcfd from a 30-foot-thick (15,840 to 15,870-ft) Beaufortian(?) sandstone at a thermal maturity of 2.45% vitrinite reflectance (calculated from Johnsson, Howell, and Bird, 1993: table 2). Play 22 is viewed primarily as a gas play.

Play 23. Fortress Mountain Formation-Deep Detached Foldbelt (UBWA2300)

Play 23 covers 5,700 mi^2 (total area within NPR-A, 11,900 mi^2) and ranges from 2,000 ft to 22,000 ft in drilling depth (most mapped prospects are between 7,000 and 12,000 ft) within the Northeast and Northwest NPR-A Planning Areas. The area for Play 23 is shown in Map 103. Play 23 involves strata of the lowermost part of the Colville basin fill in a belt of detached folds and thrust faults extending up to 60 mi north of the Brooks Range front. The complex is enclosed within a triangle zone that tapers northward beneath shallow roof thrust(s) in the Torok Formation and above floor thrusts in the lowermost part of the Fortress Mountain Formation or underlying Beaufortian sequence. A cross-section interpretation of the context and structure of Play 23 is shown in Figure App-01.

Play 23 might also extend an unknown distance southward beneath the overriding thrust stack of the Endicott/Lisburne thrust belt (Play 21). In fact, sandstones, conglomerates, and shales of the Neocomian Okpikruak Formation were encountered in the Lisburne well beneath a thrust fault bearing rocks of the Etivluk Group (Pennsylvanian to Jurassic) (Magoon and others, 1988: pl. 19.23). However, in terms of practical access for petroleum exploration drilling, the play is limited on the south by the Brooks Range front.

Play 23 consists of imbricate thrusts and duplexes in a sequence of turbiditic sandstones underlying the Torok Formation. This group of rocks has also been called the "Fortress Mountain Formation" in recognition of an apparent kinship with the Fortress Mountain Formation exposed in the foothills of the Brooks Range. The term "Fortress Mountain Formation" is applied to the subsurface play involving thrust-faulted turbiditic sandstones beneath the Torok Formation in Colville basin. However, the turbiditic sandstone sequence at the base of the Torok Formation in southern Colville basin is somewhat older (Barremian-Aptian) and it may not be directly correlative to the Fortress Mountain Formation (Albian) exposed in the southern foothills.

At the Seabee well, the Fortress Mountain Formation is 5,460 ft thick. At the Tulugak well east of the NPR-A, the Fortress Mountain Formation is 7,770 ft thick. At the Tulaga well, the Fortress Mountain Formation is 1,505 ft thick. The Fortress Mountain Formation was incompletely penetrated at Awuna (minimum thickness, 8,220 ft), East Kurupa (minimum thickness, 5,658 ft), West Kurupa (minimum thickness, 4,065 ft), and Big Bend (minimum thickness, 2,425 ft) wells. These are structural thicknesses and may include thrust repetitions.

In the Seabee and Awuna wells, individual sandstones in the "Fortress Mountain Formation" range from 10 to more than 100 ft thick, with aggregate (net) sandstone thickness up to 3,377 ft (Tulugak well), or 48%, of the penetrated thickness. Porosities are low, particularly in deeper parts of the sequence, ranging from 0 to 15%. Aggregate sandstones with sonic log porosities exceeding 10% range up to 2,293 ft (61% of net sandstone thickness) in the Tulugak well. Individual sandstones are thin, muddy, and probably low in permeability. However, a tremendous amount of sandstone is clearly present in the Fortress Mountain Formation penetrated by these wells and there is ample opportunity across the play for the occurrence of porous, reservoir-quality sandstones.

In the exposures of "type" Fortress Mountain Formation in the southern foothills, conglomerate and sandstone beds may range to several hundreds of feet thick, the thickest beds being associated with debris flows filling inner-fan channels (Crowder, 1987). Sparse measurements on surface samples from diverse sandstone facies in the Fortress Mountain Formation yielded porosities from 2% to 14% with permeabilities of less than 0.5 md (Molenaar, Egbert, and Krystinik, 1988:table 12.2).

In the parts of the play area east of 155° W. Longitude, seismic data reveal that the Fortress Mountain Formation is deformed by imbricate thrusts and duplexes that are often disharmonic to the structure of the overlying Nanushuk sequence (broad, gentle folds and triangle zones). An example of the relationship between Fortress Mountain (Play 23) and Nanushuk (Play 14) structures as observed in seismic data is shown in the cross section in Figure App-01.

In the parts of Play 23 west of 155° W. Longitude, seismic data do not clearly reveal an independent set of structures in the lower part of the Brookian sequence beneath the shallow fold train involving Nanushuk Group strata. Typically, no coherent seismic reflections are observed below the folded Nanushuk Group.

Play 23 ranges from 2,000 ft to 22,000 ft in drilling depths. The shallower structures offer the greatest potential for survival of sandstone pore systems and oil deposits. Deep structures that lie beneath the 2.0% vitrinite reflectance isograd would probably lack porous sandstones and would offer potential for gas only. Sandstones in deep structures are likely to be thoroughly compacted, offering only small amounts of relict intergranular porosity, or porosity related to fractures.

Most traps in Play 23 are fault-bend folds or duplex "horses" involving the Fortress Mountain Formation sandstones in anticlinal closures or fault-truncation closures. Seismic mapping using conventional seismic data identified 77 potential traps ranging up to 53,000 total acres in area (Tetra Tech, 1981:Maps KF-KF2). In Play 23, it is anticipated that traps will contain oil or natural gas derived from shales of the underlying Ellesmerian and Beaufortian sequences.

The seven wells penetrating the Fortress Mountain Formation in Colville basin (Awuna, West Kurupa, East Kurupa, Tulugak, Tulaga, Big Bend, and Seabee wells) encountered the top of the Fortress Mountain Formation at depths ranging from 3,000 to 6,000 ft shallower than the 2.0% vitrinite reflectance isograd. Therefore, the upper parts of the Fortress Mountain Formation in these wells are found within the depth interval in which oil accumulations might have survived thermal destruction. However, formation tests at these seven wells did not yield oil and suggest that Play 23 is gas-prone. The Seabee and Awuna wells were specifically drilled to test structures involving the Fortress Mountain Formation (Bird, 1988a:p. 95). At the Seabee well, minor oil shows and strong gas shows were widely observed in the Fortress Mountain Formation, but no tests were conducted. At the Awuna well, most sandy intervals in the Fortress Mountain Formation were associated with strong gas shows. A test of one 115-ft thick interval yielded salt water at 2,057 barrels per day (Bird, 1988b:p. 329), indicating substantial formation permeability. Gas was tested from two zones at an aggregated rate of 5,100 Mcf of gas per day in the East Kurupa 1 well (between depths of 7,000 and 9,300 ft in the Fortress Mountain Formation). In the West Kurupa well, minor oil shows were noted in sidewall cores of the Fortress Mountain Formation and gas shows were logged for most sandstones. Three tests of Fortress Mountain Formation sandstones produced small amounts of gas at rates of 5 to 10 Mcf of gas per day, with rates generally declining through the flow test periods (indicating a limited reservoir volume). Two intervals of Fortress Mountain Formation sandstones in the Tulugak well flowed gas at rates from 12 to 148 Mcf of gas per day. The Big Bend well encountered gas shows, but no oil shows. The Tulaga well encountered oil and gas shows in the upper part of the Fortress Mountain Formation but no tests were conducted.

Houseknecht and Schenk (2001) and Bird (2001) have described an area on Desolation Creek where thick turbiditic sandstones of the Torok Formation are oil stained, friable, and may represent an exhumed oil field (Houseknecht, 2000, pers. comm.) lying east of NPR-A, south of the Grandstand well and within an eastern extension of Play 23. The location of these oil-stained sandstones is shown in Map 103. The structural context for the oil-stained sandstones is shown in the cross section in Figure App-01.

South of Colville basin, minor shows of oil, gas, and asphaltic oil were noted in pre-Fortress Mountain (Neocomian Okpikruak Formation) rocks in the Lisburne well (Husky Oil NPR Operations, Inc., 1983:p. 14). Solid hydrocarbon material filling fractures up to 25 cm wide are widely observed in field exposures of the Fortress Mountain Formation in the southern foothills, possibly documenting important oil migration (Molenaar, Egbert, and Krystinik, 1988:p. 271).

C. Conceptual Aspects of the Geologic Modeling Approach

There are several conceptual differences between the present (2002) assessment and the 1997 MMS/BLM assessment of the Northeast NPR-A Planning Area.

- The present assessment analyzes 3-D seismic surveys in the Northeast NPR-A Planning Area for indicators of potential stratigraphic traps. These data were used to forecast the numbers and size range of prospects in correlative plays across the northern half of the NPR-A. Data from nine proprietary wells drilled on leases acquired in 1999 in the Northeast NPR-A Planning Area were also incorporated into the assessment of some plays.
- The present assessment expands the area of the Alpine-correlative plays (Play 8. Beaufortian-Barrow Arch-East; Play 17. Beaufortian-Barrow Arch-West) about 30 mi southward, based on proprietary exploratory wells and seismic data. These southward revisions of play boundaries allowed the Alpine-correlative plays to capture the most promising (northern) parts and bulk of resources formerly assigned to Play 9 and Play 18. This expansion greatly increased the resources for the Alpine-correlative plays and particularly for Play 8.
- The 1997 MMS/BLM assessment does not predict huge (40 Bbbl in-place), low-gravity oil deposits similar to the West Sak and Schader Bluff reservoirs overlying the nearby Kuparuk and Milne Point fields. The MMS/BLM assessment of the correlative play (Brookian topset, Play 13) models relatively few small pools (largest pool, 28 MMbbl of oil). This modeling produces a small overall undiscovered resource potential. No accumulations of the scale of the large West Sak-Ugnu pools are anticipated in these plays in the Northwest or Northeast NPR-A Planning Areas.
- In the present assessment, unidentified prospects for each play were estimated. In most petroleum provinces, it is generally acknowledged that large numbers of prospects remain undetected, even in the most thoroughly mapped areas. "Unidentified" prospects exist for a variety of reasons. Some areas lack sufficient seismic data to map all prospects. Smaller prospects may be missed because they fall between widely spaced seismic lines, or stratigraphic prospects are missed because the seismic data lack sufficient resolution of subsurface detail. Many areas have not been tested sufficiently by drilling to understand the geology and particular relationships that operated to create oil and gas pools in those areas. At the outset of exploration of new areas, new fields and plays are often unexpectedly found while drilling to reach another targeted reservoir.
- Because unidentified prospects could contain significant resource volumes, they should be recognized in assessments of oil and gas potential. For each of the 22 geologic plays quantitatively assessed for the combined Northwest and Northeast NPR-A Planning Areas, the numbers of known or mapped prospects were supplemented with additional unidentified prospects. Estimates of the numbers of unidentified prospects are based on joint consideration of 3-D seismic mapping, completeness of mapping, well control, and the geologic complexity. In areas of complex stratigraphy or structure, sparse seismic data or well control, and uncertain geology (timing, migration paths, reservoir stratigraphy), relatively large fractions of total prospects are likely to remain unidentified. Beaufortian plays, for example, are thought to contain primarily stratigraphic prospects, so for that reason, substantial numbers of unidentified prospects were included in the prospect number distributions.
- Prospect burial depths have well-documented effects on reservoir properties. Most of the plays identified within the Planning Area have been subjected to extremes in burial depth, temperatures, and thermal maturity. Reservoir yield factors (barrels of oil recoverable per acre-foot of reservoir, or millions of cubic feet of gas recoverable per acre-foot of reservoir) are the product of variables (porosity, permeability,

hydrocarbon saturation) that vary systematically with burial depth. Overall, yield factors generally decline with increasing burial depth. For this assessment, yield factors were calculated using @RISK (commercial software) and entering probability distributions for each variable in the yield equations. Yield factors reflect the balance between depositional environment and post-depositional destructive processes related to burial conditions. The deep burial histories of Gas Belt plays have adversely affected reservoir pore systems. In contrast, reservoirs in plays along the Barrow Arch have not been deeply buried, and repeated exposures of strata at erosional unconformities may have removed earlier cements and restored porosity. Generally, the highest yield factors were assigned to the Barrow Arch plays (e.g., Play 8, 316 bbl oil/acre-ft and 0.580 MMcf gas/acre-ft) and the lowest yield factors to Gas Belt plays (e.g., Play 10, 0.164 MMcf gas/acre-ft). Arctic Platform plays suffered intermediate burial histories and therefore offer intermediate reservoir yield factors e.g., Play 9, 65 bbl oil/acre-ft and 0.483 MMcf gas/acre-ft).

- The proportion of oil and gas in reservoirs is another key variable in this assessment. The principal oil source rocks known to occur in northern Alaska (Shublik, Kingak, and Pebble Shale Formations) underlie all of the study area. Oil generated upon thermal maturation should have migrated into overlying (Beaufortian and Brookian) strata or northward (updip) toward the Barrow Arch. Consequently, the plays along the Barrow Arch have the highest probability for pooled oil (in this model, 35% chance for pools that are 100% oil). For the Lisburne and Endicott plays on the Arctic Platform, reservoirs lie below recognized oil source-rocks and hydrocarbons must be generated from unknown Paleozoic sources. Accordingly, the probability for oil pools is smaller (in this model, 10% to 30% probability for pools that are 100% oil). Shallow reservoirs in the Brookian Topset play are isolated from underlying oil sources by several thousand feet of shales (largely gas prone and often overpressured). Gas Belt plays are universally assigned a 100% gas resource mix. A relatively high potential for gas in plays west of Meade Arch is based partly upon the discoveries of gas fields and the observation of widespread gas shows. The high thermal maturity of relatively shallow rocks west of Meade Arch (based on vitrinite reflectance data in the Kugrua and South Meade wells) bolsters this notion, which seems to preclude oil from a large area of western NPR-A.
- Effective reservoir (pay) thickness is an essential factor controlling potential storage volumes and recovery from oil and gas pools. The depositional thicknesses of sandstone formations in the Beaufortian and Ellesmerian plays were probably greatest along the Barrow Arch. However, subsequent erosional events have truncated some of these rocks in northern NPR-A. Although sandstone formations deposited to the south in the Arctic Platform plays have greater preservation potential (because unconformities are incised less deeply), they become shaly and are deeply buried toward the south, adversely affecting porosity. Because of these very different processes, it was concluded that reservoir pay thicknesses are relatively similar for the Barrow Arch and Arctic Platform play groups. Pay thicknesses in Beaufortian and older plays far to the south of Barrow Arch in the Gas Belt areas are much less because of distal depositional environments and destruction of porosity/permeability related to deep burial.
- Exploration chance is an estimate of the statistical frequency of occurrence of oil and gas accumulations in a play. The exploration chance is important to play assessment because it determines the fraction of prospects (or fraction of potential petroleum storage volume) that will be filled with petroleum rather than water. In this way, the exploration chance directly determines play resource endowments. The probability that a play will have at least one hydrocarbon accumulation (i.e., the play is "successful") is termed the play chance. But even if it is known that a play is "successful", it is then necessary to also estimate the proportion of the untested prospects in the play that will be "successful"--that is, the fraction of prospects that can be expected to contain some form of petroleum rather than water. The probability that any given prospect within a play will be filled with petroleum is termed the prospect chance. Play and prospect chances, estimated as decimal fractions, are multiplied to obtain exploration chance. Each play is associated with an independent exploration chance. The exploration chance is predicated on geological factors, rather than economic factors, in the GRASP model. Geologic success is defined as the existence of pooled hydrocarbons that can be recovered from a well bore rather than some minimum pool size. Conventional hydrocarbon accumulations do not include continuous-type deposits (non-pooled) or those not recoverable by standard technology. The Barrow Arch has gathered migrating hydrocarbons into traps all along its crest. All petroleum generated in areas to the north or south of Barrow Arch has tried to migrate to the arch. Some hydrocarbons reach the arch and some were trapped en route on the flanks of the arch. By a coincidence of geologic history, Ellesmerian and Beaufortian rocks are in a more proximal (shallow water) setting (higher quality reservoirs) along the Barrow Arch. For these reasons, plays along the Barrow Arch have the highest exploration chances. By contrast, the low exploration chances for the Gas Belt plays reflect a combination of negative factors including the deep water deposition (thin, muddy reservoirs), the destruction of reservoir quality (deep burial and compaction of pores), and the poor

seismic definition for deeply buried subtle traps.

D. Geologic Assessment Results

The assessment of conventionally recoverable hydrocarbon potential is summarized as a cumulative probability graph (Fig. App-02), representing the aggregation of the 22 geologic plays analyzed in the Northwest NPR-A Planning Area. Separate curves for oil (including crude oil plus natural gas liquids), gas (including non-associated and associated gas), and BOE (barrels-of-oil equivalent) are shown. The BOE sums the oil and gas resources on an energy-equivalent basis, where 5,620 ft^3 gas is presumed to equal the energy content of 1 bbl of oil. These resources represent pooled hydrocarbons that are recoverable with conventional technology and without regard for economic viability.

Fig. App-02 illustrates a very important concept: undiscovered resource volumes should be portrayed in the context of probability distributions to reflect the uncertainties associated with the input model data. There is a much higher probability of occurrence for small resource volumes than for large resource volumes. For example, there is a 95% chance (19-in-20 chance) that the combined Northeast and Northwest NPR-A Planning Areas contain at least 6.817 BBO (billion barrels oil), and there is a 5% chance (1-in-20 chance) the planning areas contain 11.817 BBO. The oil resource differential across this probability range represents about a twofold increase based entirely on the probability level. Other probabilities can be selected for statistical summaries (for example, 90% or 9-in-10 chance). More frequently, the mean of the distribution is used to compare or summarize results for different plays or areas. Important concepts to remember include: 1) the fact that a wide range of possibilities for resource potential is typical for estimates because oil and gas assessments are based on uncertain data input as ranges; and 2) potential resource volumes should be presented in the context of associated probabilities, where large volumes are less likely than small volumes .

To summarize the information contained in the cumulative probability curves, the risked mean oil volume (including crude oil and gas-condensate) is 9.101 BBO, and the risked mean gas volume (including both associated and non-associated gas) is 37.309 Tcf. These risked mean (or expected) volumes fall within wide ranges of resource potential. Recoverable oil volume estimates range from 6.817 to 11.817 BBO (95% and 5% probabilities), and corresponding gas volumes could range from 23.002 to 56.213 Tcf (95% and 5% probabilities). Aggregated oil and gas resources are represented as BOE (barrels of oil equivalent). The mean resource aggregate for the combined Northwest and Northeast NPR-A Planning Areas is 15.740 billion BOE, with extreme ranges (95% and 5% probabilities) of 11.358 to 21.057 billion BOE.

The individual contributions of the 22 plays are displayed in Table App7-01 . Reported play endowments are provided for 95% probability (F95), the mean, and 5% probability (F05) levels. It is apparent that four plays (Play 6. Sadlerochit-Barrow Arch-East; Play 8. Beaufortian-Barrow Arch-East; Play 14. Brookian Foldbelt; and Play 23. Fortress Mountain-Deep Detached Foldbelt) dominate the resource potential of the combined Northwest and Northeast NPR-A Planning Areas, accounting for 80% of the total oil potential and 66% of the total gas potential. Each of these four plays offers "high-side" (5% chance) oil resource potentials over a billion barrels. Two other plays are of secondary importance (Play 1. Endicott-Barrow Arch-East and Play 11. Brookian Turbidites-Arctic Platform-East), and together these plays contribute 10% of the total oil resources.

It is important not to focus exclusively on the mean resource volumes of plays. Large pools - rare perhaps, but possible - in some of the low-resource plays could become commercial fields. The mean sizes of the three largest oil and gas pools in each play are listed [illegible] Table App 7-01. Mean resource volumes are reported for these pools, but each pool has a high potential volume associated with a low probability. For example, the largest oil pool (rank 2) in Play 8 is 634 MMbbl of oil in mean volume. For this same pool, there is a 5% chance that 1,611 MMbbl of oil could be present. All of the pools listed in Table App 7-01 have maximum potential sizes that are two to three times larger than the size at the mean. Figure App-03 displays a pool rank plot for the

Alpine-correlative Play 8. Here, the oil and gas contents of the141 possible pools are displayed as ranges (lengths of vertical bars) of possible resources between the 75% and 25% probability levels.

E. Economic Assessment

The purpose of the economic assessment is to determine the portion of the undiscovered, conventionally recoverable hydrocarbon endowment that is commercially viable (produced at a profit) under given engineering and economic conditions. The PRESTO computer program developed by MMS performs the economic analysis. PRESTO simulates activities beginning with the discovery of an oil or gas pool and ending with delivery of the hydrocarbons to market. The computer model schedules the costs associated with exploration, development, and production in relation to the income from sales of oil and gas. A discounted cash-flow analysis calculates the net present value of development of a hypothetical discovery under different sets of randomly sampled geologic, engineering, and economic variables. Each PRESTO run is composed of 1,000 trial simulations. Pools simulated with positive net present value are added to play-level resource totals and then play-level resources are aggregated to recoverable estimates for the entire assessment area.

It is important to acknowledge that the computer simulations are made without knowledge of exact prospect locations, and many of the prospects are unmapped at the present time. The modeling simulations occur in an artificially compressed time frame, generally "discovering" all pools within the primary lease term (10 years). The annual funding and drilling equipment required to reproduce this exploration effort is unprecedented. Also, site-specific engineering requirements for future field developments in the NPR-A could differ markedly from the generalized engineering models assumed for our assessment. The cost and delays associated with regulatory actions are not considered at this stage of the economic evaluation.

The cost of dry holes prior to making a commercial discovery is not added to the economic burden of simulated discoveries. Given the high cost of operations in northern Alaska, successful early exploration efforts are the key to continued industry funding. Future price expectations and possible technological advancements influence corporate strategies and funding, but these factors cannot be accurately evaluated because each company may have different concepts. Generally speaking, higher oil prices could spark more industry interest in exploring a new area. Increased exploration drilling could result in more discoveries. Challenging conditions are likely to drive technology advancements to lower unit costs and recover larger portions of the resource base to increase profitability. A contrary set of circumstances--such as a series of expensive, dry exploration wells coupled with low oil prices--could force industry to abandon an area before making any commercial discoveries. However, temporary changes in industry attitudes do not affect the available resource potential calculated by the PRESTO model.

At the present time there is no transportation system to move natural gas from the North Slope to outside markets, and huge volumes of gas resources discovered in northern Alaska have been stranded for decades. Recently, numerous proposals to commercialize the stranded resources are being discussed by industry and government groups. A new gas transportation system (likely a large diameter pipeline) seems far more likely today than five years ago. New discoveries of associated (with oil pools) and nonassociated gas (separate from oil pools) in the NPR-A could feed into a future gas transportation system when it is constructed. Considering the long lead-time between leasing and production for remote areas of the North Slope, the timing for a future pipeline system could fit with new discoveries in the NPR-A. Consequently, an economic analysis of natural gas production has been included, assuming that a major transportation system is available to carry gas production from NPR-A. A tariff of $2.50 per Mcf was applied to the economic simulation to cover the costs of conditioning and transportation of natural gas from the Prudhoe Bay area to markets in the U.S.

1. Economic Modeling Approach

The operational aspects of the PRESTO computer model are discussed in detail in Sherwood et al (1998) and only some basic concepts of the model are discussed here.

The economic results are controlled to a large degree by the preceding geologic assessment. This is because pool characteristics determined by the GRASP geologic model are transferred as input parameters into the PRESTO economic model. Although variables are randomly sampled in PRESTO, the midpoints of the input distributions are sampled more frequently than the extremes of the distributions. Although extreme cases are theoretically possible, geologic plays with small pools and thin reservoirs are likely to be evaluated as poor economic plays.

Although the geologic assessment analyzed 22 plays, many of these plays are highly unlikely to contain economic resources (pools too small and remote). Screening criteria were used to separate the plays with possible economic potential from those unlikely to have any economic potential. The screening criteria for economic modeling were:

1. plays contain less than 1% of the total oil or gas resources;
2. the mean size of the largest pool in the play is less than current satellite developments; and
3. plays are unproven with no discoveries made to-date.

These screening criteria reduced the original 22 GRASP plays to 11 plays assessed by the PRESTO model.

Although the assessment is described as a play-based analysis, the basic units of the PRESTO model are individual pools. The PRESTO computer program conducts a pool-by-pool development simulation under changing geologic, engineering, and economic variables. If individual pools cannot support the costs of development wells, facilities, and pipelines, these resources do not contribute to the play-level resource volumes. The possibility that small satellite pools could be developed at somewhat lower unit costs by sharing nearby infrastructure is difficult to model properly in PRESTO because of the intrinsic stand-alone field assumptions.

Under normal circumstances, the first pools developed in an area must support the initial costs of new infrastructure, such as staging areas, processing facilities, and main pipelines connected to TAPS. The added costs for new infrastructure are supported by realizing the economies of scale for large projects. This means that the biggest fields are usually developed first. To accommodate this typical situation, a complicated set of capital cost inputs (for new infrastructure) and tariffs (costs to share existing infrastructure) were used for play groups in the same area. All oil and gas production from NPR-A was assumed to utilize North Slope infrastructure, such as common-carrier pipelines, TAPS and tankers, with transportation costs defined by published tariffs.

Prospect mapping using seismic data is important in MMS/BLM assessment efforts. Prospects are identified on regional maps or extrapolated from trend maps in adjacent areas containing the same play conditions. To account for prospects that have not been mapped (either because they lack seismic data or they are not mappable with the available data) extrapolations of prospect size and number are made from geologic analogs. Structural prospects are usually identified and tested first in a frontier area. Later play concepts involving stratigraphic plays (for example, the Alpine-equivalent plays) depend on the availability of advanced 3-D seismic data. Because these data sets are not routinely collected as part of early regional surveys in the exploration phase, stratigraphic plays carry an extra level of uncertainty with regard to the size and location of new prospects. The location and characteristics of a potentially commercial pool can only be confirmed by actual drilling.

The PRESTO program applies variables using ranges for most engineering parameters. To allow for a more realistic simulation, ranges for costs are varied 25% around the most-likely (or mode) value. This accounts for the uncertainties associated with different states of nature. No attempt is made to forecast new engineering technology that might be developed in response to higher-than-normal commodity prices. Conventional technology and standard North Slope engineering practices are assumed by the simulation model.

Economic assumptions are reviewed and modified (if necessary) for each resource assessment, and minor revisions were made for the present work as compared to the 1999 assessment for the Northeast Plan area. Changing geologic assumptions and economic inputs can produce differences between present and past assessments. For the present assessment, economic and engineering cost inputs assume 2002 as the base year, and commodity prices and costs are inflated equally at a constant rate of 3%. The discount rate approximates the after-tax rate of return on investment. Cash flow items are discounted/deflated back to present dollars using a combined rate of 15.4% (1.12 discount x 1.03 inflation).

Price adjustments were made for the quality of crude oil for each play. The play-level price adjustments range from -$1.20/bbl for 20° API crude oil to +$1.00/bbl for 40° API light oil. This approximation replicates the Quality Bank Allowance (QBA), since the State of Alaska does not release the QBA data for individual North Slope fields. All North Slope oil production is added to the Alaska North Slope (ANS) stream carried by TAPS and tankers to assumed West Coast markets. The standard ANS crude oil (now 28° API) is given a -$.60 price adjustment for quality relative to World Oil (32° API), which is a composite of sources that are delivered to domestic refineries.

2. Economic Assessment Results

The results of the economic evaluation are summarized in the price-supply curves (displayed as Figure App-04 and Figure App-05) which show resource volumes (horizontal axis) plotted in relation to commodity prices (vertical axis). Despite the inverted plotting format, price is the independent variable and resource volume is the dependent variable. Typically, an increase in oil or gas prices will result in an increase in the volume of oil or gas that can be profitably recovered. This is because the increased value of the production stream offsets the higher development costs for smaller fields with higher unit (per-barrel) costs. At very high (perhaps unrealistic) prices, the economically recoverable resource curves approach the conventionally recoverable endowment. Oil and gas prices are linked in the model using a volume factor of 5.62 thousand cubic ft per barrel (Mcf/bbl) and BTU-price discount factor (0.80).

Price-supply curves are fully risked resource volumes, including: 1) the geologic risk that hydrocarbons are pooled and recoverable from reservoirs; and 2) the economic risk that the pools, if discovered, would generate a positive cash flow through their field life. Possible investment risk associated with access and regulatory restrictions are not accounted for in the PRESTO model. However, potential costs associated with access limitations and mitigation requirements are treated in a later analysis for leasing and development scenarios. The price-supply analysis does not imply that all of the hydrocarbon resources will be converted to producing reserves in a specific timeframe, only that they are theoretically present and could be commercially viable if discovered. In the PRESTO model, all pools are "discovered" and developed by simulation. However, historical experience has shown that it is unlikely that enough wells will be drilled to completely evaluate the resource potential of any area. With a lesser exploration effort, the estimated resource potential may never be realized as actual production.

As discussed previously, the mean geologic resource endowments (undiscovered, conventionally recoverable) are 9,101 MMbbl of oil and 37.309 Tcf of gas for the combined Northwest and Northeast NPR-A Planning Areas. For purposes of discussion, crude oil and gas-derived liquids are counted as "oil." Non-associated gas and associated/dissolved gas are counted as "gas." The price-supply curves for oil and gas (Figure App-04 and Figure App-05) indicate a clear correlation to market prices. No resources are economically recoverable at prices below approximately $15.00/bbl ($2.14/Mcf). At a benchmark price of $18.00 ($2.56/Mcf) only 134 MMbbl of oil and 0.212 Tcf of gas are economically viable, representing 1.5% (oil) and 0.5% (gas) of the total geologic resource base. The fraction of economically recoverable resources rises quickly at prices above $20.00/bbl ($2.85/Mcf), increasing more than four-fold at a price of $25.00/bbl ($3.56/Mcf). At $27.00/bbl ($3.84/Mcf), at least one economic pool was discovered in each of the 1,000 simulation runs. At a benchmark price of $30.00/bbl

($4.27/Mcf), 5,697 MMbbl of oil and 15.830 Tcf of gas are economically viable, representing 63% (oil) and 42% (gas) of the mean geologic resource base.

Commodity prices have a major influence on economically recoverable volumes. Higher commodity prices invariably lead to higher resource recovery. Because the resource estimates will be used primarily for lease sale planning and environmental impact analysis, some reasonable price brackets were selected. With regard to probability levels, the mean resource case is the most relevant because it represents the average statistical outcome of the economic analysis. In economic terms, the risked mean case is often referred to as the "expected value." Another advantage to using the risked mean is that components (individual plays, sub-areas, and other items) can be added and subtracted without violating statistical principles.

Two price levels were used to bracket economically recoverable oil and gas volumes. The $18.00/bbl price represents normal, historical conditions and the $30.00/bbl price represents improbable, high-side conditions. Long term prices above $30.00/bbl could prompt advancements in technology as well as changes in energy consumption that would affect many of the economic assumptions in the model. It is important to remember that the bracketing prices represent long-term averages of real (inflation-adjusted) values considering that a typical field life could span decades. These bracketing prices should not be compared to short-term price spikes that occur over a few months or years. The Energy Information Agency (U.S. Dept. of Energy, 2001) provided a 2010 forecast of a "low price" ($17.64/bbl, in year 2000 dollars) and "high price" ($30.01bbl, in year 2000 dollars) level. These EIA prices correspond to $19.28 and 32.79 in 2003 dollars.

The resource allocation for each play in the combined Northwest NPR-A and the Northeast NPR-A Planning Areas is given in Table App 7-02 using the bracket prices of $18.00/$2.56 and $30.00/$4.27, respectively. The oil and gas volumes listed in Table App 7-02 were gathered from the PRESTO printout (not picked from price-supply graphs). Using the low-price ($18.00/$2.56), only two of the eleven plays contain 97% of the undiscovered economic oil resources and 98% of the undiscovered economic gas resources. The Beaufortian, Barrow Arch-East play is an extension of the recent discoveries at Alpine and adjacent areas in Northeast NPR-A Planning Area. The Sadlerochit, Barrow Arch-East play has similarities to the rich fields surrounding the super-giant Prudhoe Bay field. Using the high-price bracket ($30.00/$4.27) six plays contribute to the economic resource base, however the Beaufortian play still dominates the economic oil (73%) and gas (55%) potential. Two plays located in the southern part of the assessment area (Brookian Foldbelt and Fortress Mountain) hold estimated gas resources amounting to 32% of the total economic resources at $4.27/Mcf.

F. MMS/BLM and U.S. Geological Survey Assessments

Summaries of the results of a U.S. Geological Survey (USGS) resource assessment of NPR-A were released as web site postings in May 2002 (Bird and Houseknecht, 2002a; 2002b). A comparison of the USGS and MMS-BLM assessments completed in 2002 shows that both assessments reach the same fundamental conclusions. Perceived differences between the USGS and MMS-BLM assessments arise mainly from the different geographic areas considered by the assessments. The USGS assessed the entire NPR-A while the MMS-BLM assessed a subarea of NPR-A (the combined Northwest and Northeast Planning Areas). The combined Northwest and Northeast Planning Areas occupy 62 percent of the land area of NPR-A. Further complicating direct comparisons of these assessment results is the fact that the combined Northwest and Northeast Planning Areas enclose the oil-prone areas of northern and eastern NPR-A and exclude some of the gas-prone areas of southern and western NPR-A. These differences in land areas and geological biases lead to some minor differences in results of the MMS-BLM and USGS assessments. If these differences are set aside, the results of the USGS and MMS-BLM assessments are seen to be broadly consistent in the critical areas of: (1) overall oil and gas resources proportioned to the areas assessed; (2) identification and quantification of dominant plays; (3) forecasts for maximum sizes of hypothetical, undiscovered oil and gas pools; and (4) estimated quantities of economically recoverable oil.

Overall Oil and Gas Resources Proportioned to the Areas Assessed. The 2002 USGS assessment (Bird and Houseknecht, 2002a) estimated that the entire Federal part of NPR-A (excludes State of Alaska waters along the coast and Native lands within NPR-A) may contain mean undiscovered resources of 9.3 billion barrels (Bbbl) of oil and 59.7 trillion cubic feet (Tcf) of non-associated (no oil present) natural gas. To obtain the total resource endowment, add 1.37 Bbbl of natural gas liquids (NGL) and 10.3 Tcf of associated gas (solution and gas cap gas), reported separately as part of the USGS assessment by Schuenemeyer (2003). Total undiscovered resources of 10.67 Bbbl oil (crude oil plus NGL) and 70.0 Tcf gas (non-associated plus associated) were obtained for the 2002 USGS assessment of the entire Federal part of NPR-A.

The 2002 MMS-BLM assessment (this study) estimated that the combined Northwest and Northeast Planning Areas contain mean undiscovered resources of 9.101 Bbbl oil (crude oil plus NGL) and 37.309 Tcf gas (non-associated plus associated). Thus, the outward volumetric differences between the two groups amount to 17% more for oil and 88% more for gas in the USGS results.

The MMS-BLM and USGS assessments are more consistent if the different sizes and petroleum characteristics of the assessed areas are accounted for. The MMS-BLM assessment area captures 62% of the entire Federal area of NPR-A. The MMS-BLM results for the combined Northwest and Northeast Planning Areas indicate 9.101 Bbbl or 85% of the 10.67 Bbbl NPR-A (Federal part) oil/NGL endowment reported by the USGS. The proportion of oil (85%) associated with the MMS-BLM assessment area exceeds the proportion of NPR-A land surface area (62%) captured by the MMS-BLM assessment because the northern and eastern parts of NPR-A are relatively oil prone. Both assessments indicate that the northern and eastern parts of NPR-A are enriched in oil resources relative to gas resources. Considering natural gas, the MMS-BLM results for the combined Northwest and Northeast Planning Areas indicate 37.309 Tcf or 53% of the 70.0 Tcf NPR-A (Federal part) total gas endowment reported by the USGS. This is consistent with the fact that the USGS assessment includes the gas-prone 38% of the NPR-A land area that lies outside the combined Northwest and Northeast Planning Areas, and complements the geological bias of the combined Planning Areas toward oil. The distortions of assessment results caused by geological bias are diminished if the gas resources in both assessments are converted to oil-equivalent resources by setting each barrel of oil equal to 5,620 cubic feet of gas on an energy-equivalent basis. The MMS-BLM assessment thus finds a total endowment of 15.740 Bbbl-equivalent, 58% of which is oil. By the same process, the USGS assessment finds a total endowment of 23.126 Bbbl-equivalent, 46% of which is oil. The MMS-BLM energy-equivalent endowment is 68% of the USGS energy-equivalent endowment, fairly close to the proportion of NPR-A land area (62%) captured by the combined Northwest and Northeast Planning Areas.

Identification and Quantification of Dominant Plays . The MMS-BLM and USGS assessments both view the Alpine plays (those correlative to the rocks containing the 500 MMbbl Alpine oil field) as the dominant plays in NPR-A. The Alpine plays offer the highest resource potential and are driving current exploration programs in NPR-A. Both assessments use the term Beaufortian to identify the groups of plays that are correlative to the Alpine oil field. For the MMS-BLM assessment of the combined Northwest and Northeast Planning Areas, 56% (5.068 Bbbl) of the oil endowment of the assessment area (9.101 Bbbl) is associated with Beaufortian plays. For the USGS assessment of the entire NPR-A (Federal land, State waters, and Native lands), 69% (7.233 Bbbl) of the overall oil endowment (10.558 Bbbl) is associated with Beaufortian plays (these oil quantities are from Bird and Houseknecht, 2002b, and do not include NGL).

Forecasts for Maximum Sizes of Hypothetical, Undiscovered Oil and Gas Pools. The sizes of the undiscovered oil and gas pools forecast by the MMS-BLM and USGS assessments are consistent. This is important because the sizes of the largest hypothetical oil pools are critical to success in the economic modeling. Individual pools must support a costly infrastructure, and profitable development economics require a large asset. A play with a large overall oil endowment but consisting of many small pools will have no economic value.

In the 2002 MMS-BLM assessment of the combined Northwest and Northeast Planning Areas, the largest hypothetical undiscovered oil pool is forecast to contain 634 MMbbl (on average, within a possible range from 128 to 1,610 MMbbl). This pool is associated with play 8 (a Beaufortian play correlative to the Alpine oil field of

500 MMbbl). The next largest oil pool in the same play contains 441 MMbbl. The 2002 USGS assessment of NPR-A does not report specific pool sizes but identifies one oil pool in the size range of 512 to 1,024 MMbbl, associated with a Beaufortian play correlative to the Alpine oil field (Bird and Houseknecht, 2002a:figs. 5, 6). Both assessments forecast one oil pool in the size range of 512 to 1,024 MMbbl as the largest in their respective assessment areas. In both assessments, the largest pools are associated with Beaufortian plays.

In the 2002 MMS-BLM assessment of the combined Northwest and Northeast Planning Areas, the largest hypothetical undiscovered gas pool is forecast to contain 2.861 Tcf gas (mean size, with a possible range from 0.279 to 8.912 Tcf). This pool is associated with MMS-BLM Beaufortian play 8. The 2002 USGS assessment identified approximately 8 hypothetical undiscovered gas pools in the size range from 1.536 to 12.288 Tcf gas (Bird and Houseknecht, 2002a:fig. 5). The USGS assessment forecasts more gas pools of the largest size classes mostly because it includes a large gas-prone part of NPR-A that lies outside the MMS-BLM assessment area.

Estimated Quantities of Economically Recoverable Oil and Gas. The economic results of the MMS-BLM and USGS assessments are also quite consistent. The 2002 MMS-BLM economic assessment of the combined Northwest and Northeast Planning Areas forecasts that 5,697 MMbbl of oil and NGL (mean) will be economically recoverable at a market oil price of $30/bbl. The 2002 USGS economic assessment of NPR-A forecasts that 5,720 MMbbl of oil and NGL (mean) will be economically recoverable at a market oil price of $30/bbl (Attanasi, 2003:tbl. 4; Bird and Houseknecht, 2002:fig. 7). The economic results of both assessments are essentially identical and reflect the fact that both assessment areas capture those areas and plays that are most promising for economic discoveries.

The MMS-BLM reports economically recoverable gas estimates, largely because of the gas resources associated with the Beaufortian plays and the assumption that a transportation system will be available to receive new gas supplies from NPR-A in the foreseeable future. The 2002 USGS assessment did not report economic quantitites of natural gas because the major gas transportation system does not exist at the present time.

Summary. The results of the MMS-BLM and USGS assessments confirm a shared view of the fundamental petroleum attributes of NPR-A, despite the fact that two independent teams assessed different areas using different computer models. Independent studies must inevitably produce some differences in detail, but both assessments strongly agree on the fundamental geological drivers of future oil development in NPR-A.

G. Endnotes

[1] Using a geothermal gradient of 28° C/km, the maximum reported among wells in the southern Colville basin by Deming et al. (1992:table 1).

[2] Surface of equal thermal maturity, in this case represented by equal values of vitrinite reflectance, a property of particles of organic matter that is measured with special microscopic equipment in the laboratory on prepared well samples.

[3] No oil sources have been recognized among the pre-Triassic sequence north of the Brooks Range.

[4] Permian rocks occur at the top of the Lisburne Group in the Inigok well, just south of the play area (Molenaar, Bird, and Collett, 1986).

[5] Average porosity 22% in Prudhoe Bay field (Melvin and Knight, 1984; AOGCC, 1994:p. 95).

[6] Uppermost sandstone in Kuparuk field (Carman and Hardwick, 1983), but here occurring as an unconformity sandstone locally mantling the Lower Cretaceous unconformity.

[7] Generally entirely Jurassic in age to north in correlative Arctic Platform (Plays 9 and 18) and Barrow arch (Plays 8 and 17) plays.

[8] Specifically, the Kurupa-Umiat lobe of Huffman, Ahlbrandt, and Bartsch-Winkler (1988:fig. 13.11).

[9] Lower Cretaceous sandstone resting directly upon the Lower Cretaceous unconformity (LCU).

[10] Specifically, the Corwin lobe of Huffman, Ahlbrandt, and Bartsch-Winkler (1988, fig. 13.11).

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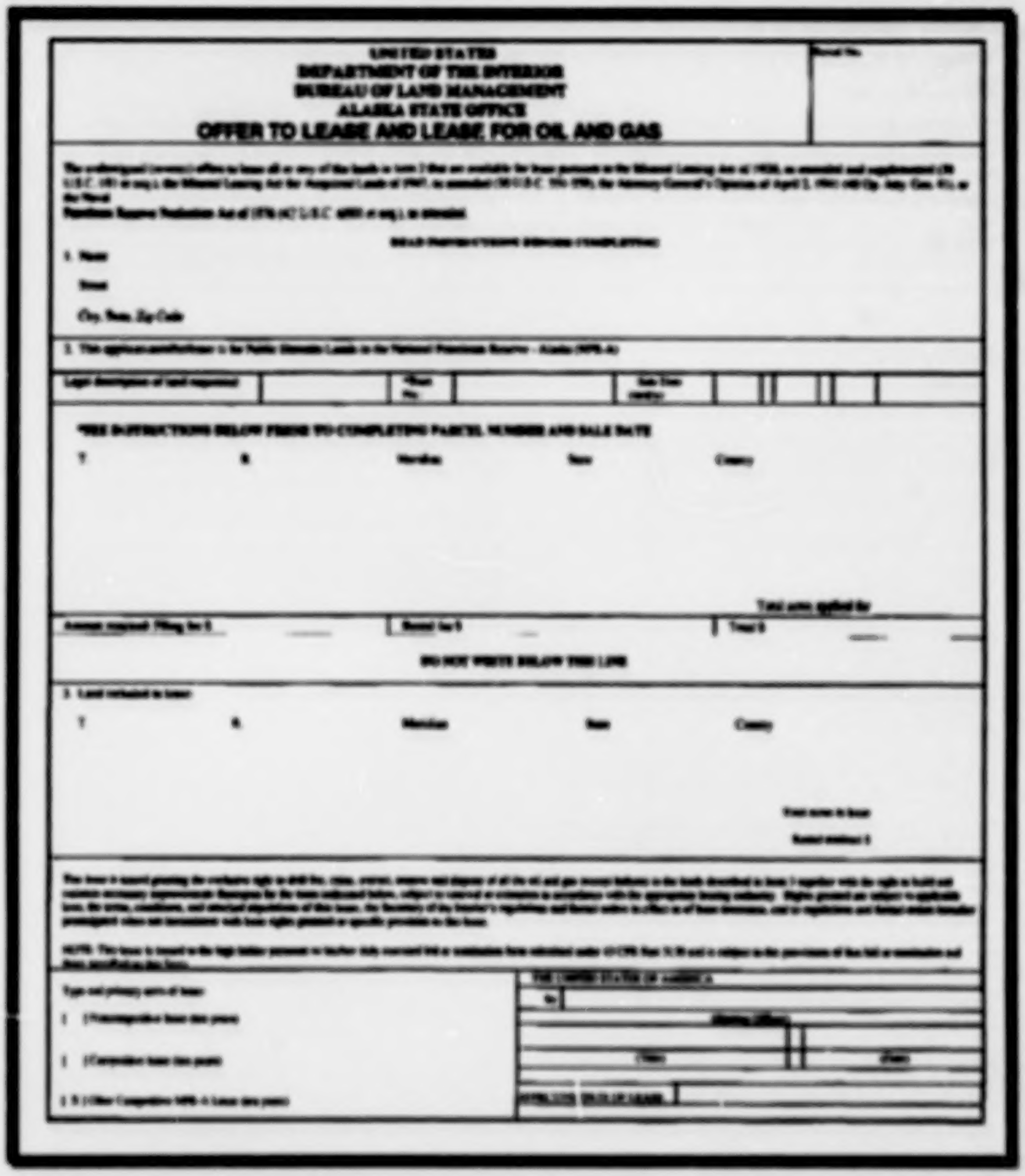
Appendix 8

BLM Lease Offering: Form AK 3130-1

APPENDIX 8. BLM LEASE OFFERING: FORM AK 3130-1



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALASKA STATE OFFICE
OFFER TO LEASE AND LEASE FOR OIL AND GAS

1. Name

Street

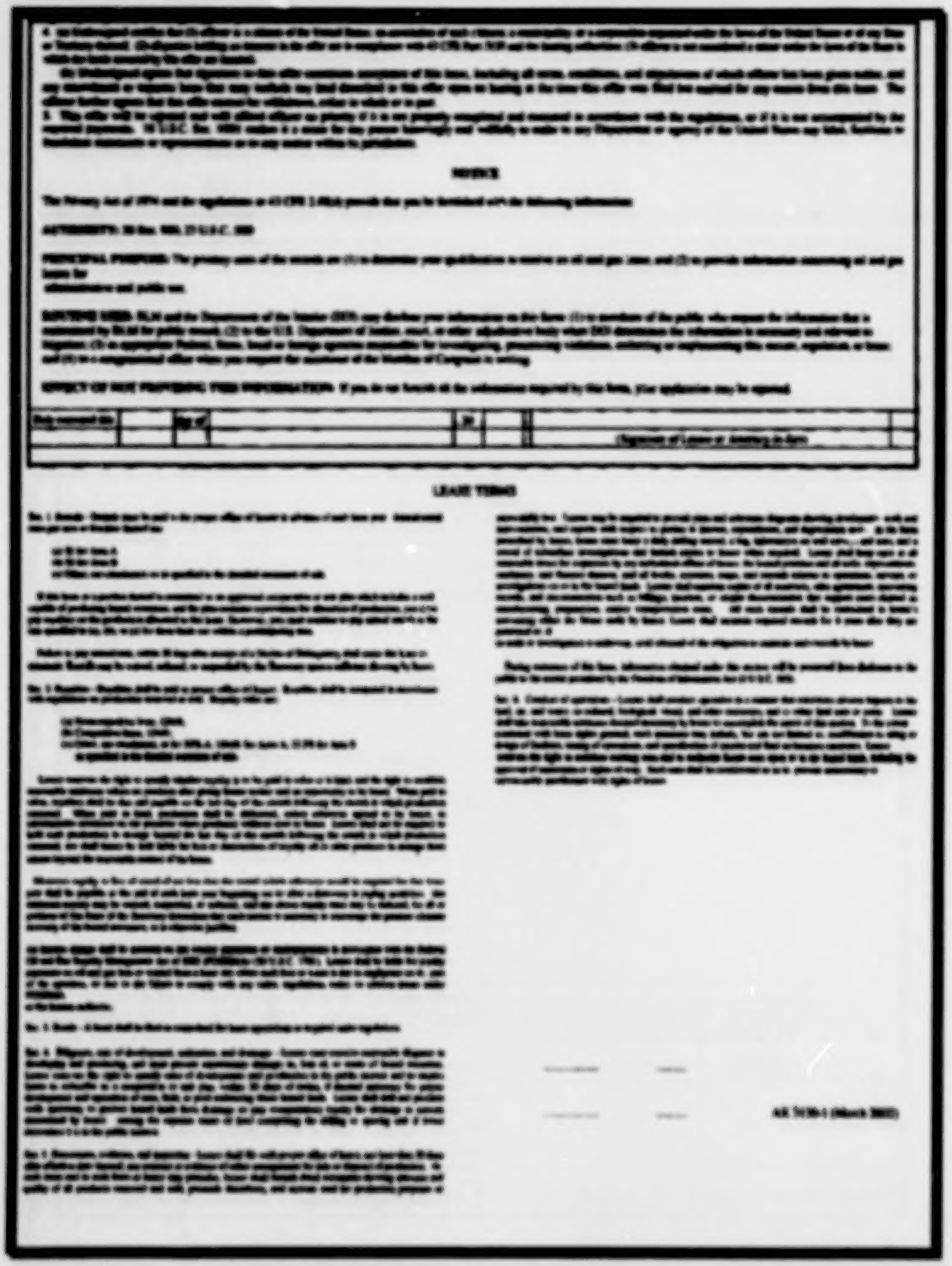
City, State, Zip Code

T R Meridian State County

DO NOT WRITE BELOW THIS LINE

T R Meridian State County

THE UNITED STATES OF AMERICA



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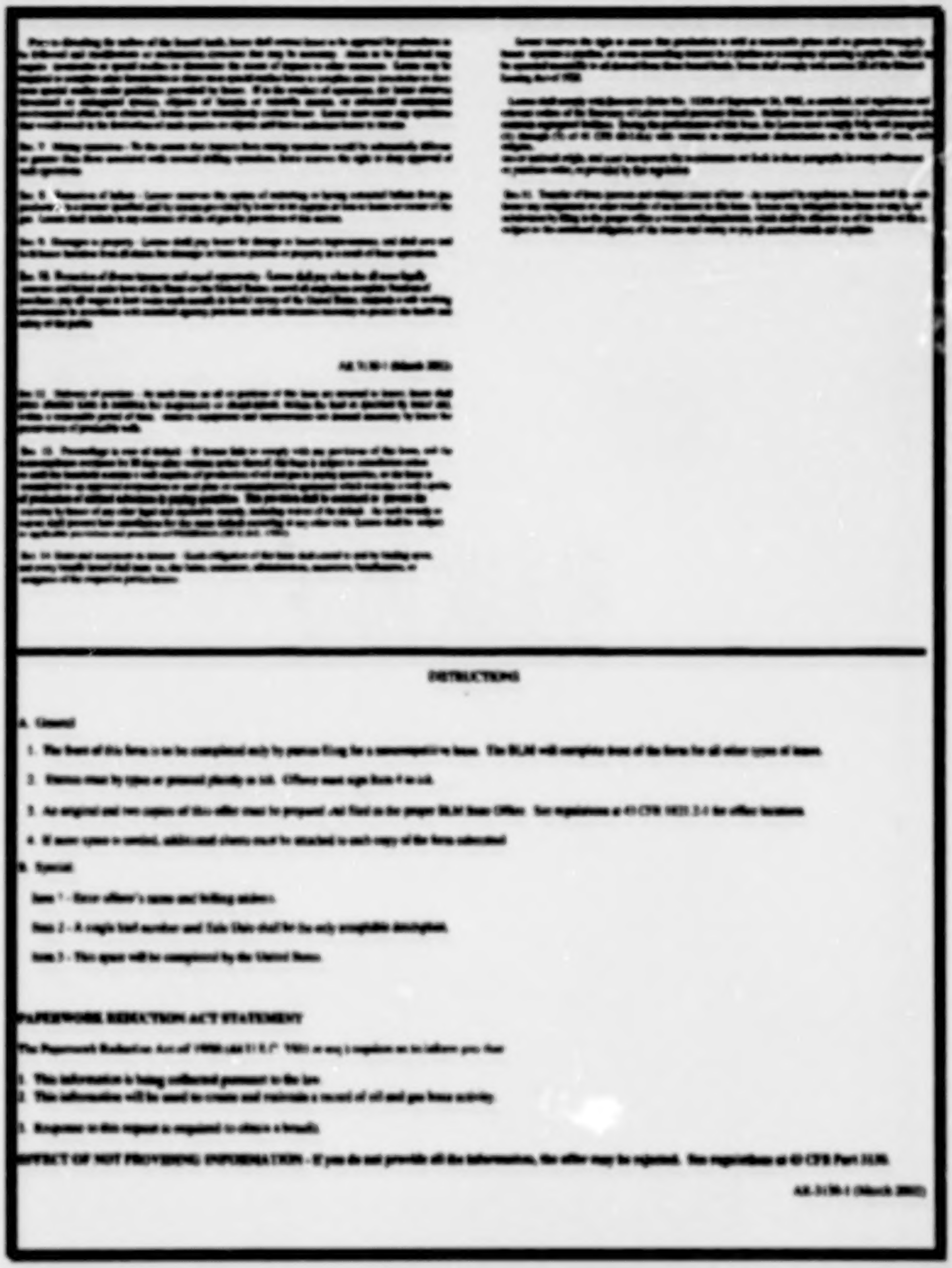

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INSTRUCTIONS

A. General

1. The front of this form is to be completed only by parties filing for a noncompetitive lease. The BLM will complete front of the form for all other types of leases.

2. Entries must be typed or printed plainly in ink. Offeror must sign Item 4 in ink.

3. An original and two copies of this offer must be prepared and filed in the proper BLM State Office. See regulations at 43 CFR 1821.2-1 for office locations.

4. If more space is needed, additional sheets must be attached to each copy of the form submitted.

B. Special

Item 1 - Enter offeror's name and billing address.

Item 2 - A single tract number and Sale Date shall be the only acceptable description.

Item 3 - This space will be completed by the United States.

PAPERWORK REDUCTION ACT STATEMENT

The Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.) requires us to inform you that:

1. This information is being collected pursuant to the law.
2. This information will be used to create and maintain a record of oil and gas lease activity.

3. Response to this request is required to obtain a benefit.

EFFECT OF NOT PROVIDING INFORMATION - If you do not provide all the information, the offer may be rejected. See regulations at 43 CFR Part 3130.

AK-3130-1 (March 2002)

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Appendix 9. Information, Models, and Assumptions Used to Analyze the Effects of Oil Spills

This Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) analyzes oil spills and their relative impact to environmental, economic and sociocultural resources and resource areas that could result from onshore oil exploration and development in the Northwest NPR-A Planning Area. Predicting an oil spill is an exercise in probability. Uncertainty exists regarding the location, number, and size of oil spills; the chemistry of the oil; and the environmental conditions at the time of a spill. Although some of the uncertainty reflects incomplete or imperfect data, a considerable amount of uncertainty exists simply because it is difficult to predict events 15 to 40 years into the future.

Assumptions about oil spills are used to analyze the effects from oil spills. The assumptions are derived from estimates regarding the type of oil, the source of an oil spill, the general location and size of a spill, the chemistry of the oil, how the oil will weather, how long it will remain, and where it will go. The assumptions are supported by project-specific information, statistical analysis, and professional judgment. Based on these assumptions, a "scenario" is created to reflect a spill, and the effects are analyzed. This constitutes a "what if a spill occurs" analysis. After the effects of the oil spill scenario are analyzed, the chance of an oil spill occurring is estimated.

This analysis considers the entire production life of the Northwest NPR-A Planning Area and assumes that commercial quantities of hydrocarbons are present in the Planning Area and that these hydrocarbons will be developed and produced at the estimated resource levels presented in the IAP/EIS. Uncertainties exist, such as 1) the estimates required for the assumed resource levels, 2) the actual size of a crude- or refined-oil spill, 3) the approximate location of oil assumed to be produced, or 4) whether production would occur at all. If no hydrocarbons exist, there is no chance of a crude-oil spill occurring in the Planning Area.

A. Oil Spill Size Categories

This IAP/EIS analyzes what is likely to happen in the future, using assumptions about the likely size, duration, and type of a spill to analyze the effects. To estimate these parameters oil spills are divided into two types: crude and refined spills. Crude-oil spills are divided into three size categories; small, large, and very large. Within each of these categories, generalized and specific assumptions are made about those size category spills. Refined spills fall into the small spill size category.

Spill sizes are small, large, and very large. Small spills are less than 500 bbl; large spills are greater than or equal to 500 bbl or 1,000 bbl (depending upon the data source); and very large spills are greater than or equal to 120,000 bbl. Table IV-17 shows the assumed source of a spill(s), type of oil, size of spill(s) in barrels, and the receiving environment that is assumed in the analysis of the effects of oil spills in this IAP/EIS and the section of this IAP/EIS where the effects of a large, small, and very large spill are analyzed. The effects of a large and small spill(s) are analyzed in Sections IV.C through IV.F and Section V.B; the effects of a very large spill are analyzed in Section IV.J.5. The following sections discuss the analysis and the assumptions used for analysis regarding these three size categories.

1. Large Crude Oil Spills

Large spills are defined as greater than or equal to 500 bbl for the Alaska North Slope and Trans-Alaska Pipeline System (TAPS) and greater than or equal to 1,000 bbl for the TAPS tankers. Historical information about previous large spills on the Alaska North Slope, from TAPS and TAPS tankers was used to estimate the large spill sizes that are likely to occur in the future.

a. Historical Large Crude Oil Spill Sizes

Assumptions for large spills (≥ 500 bbl) from production in the Northwest NPR-A Planning Area are based on the historic spill sizes from: 1) onshore Alaska North Slope oil industry spills from 1985 to 2000; 2) TAPS spills from 1977 to 2001; and 3) TAPS tanker spills from 1977 to 1999.

(1) Historical Crude Oil Spills Greater Than or Equal to 500 Barrels on Alaska's North Slope

The Alaska North Slope oil-spill analysis includes onshore oil and gas exploration and development spills from the Point Thompson Unit, Badami Unit, Kuparuk River Unit, Milne Point Unit, Prudhoe Bay West Operating Area, Prudhoe Bay East Operating Area, and offshore Duck Island Unit (Endicott). North Slope data include spills from onshore pipelines and offshore and onshore production and gathering facilities. The following information does not include spills on the Alaska North Slope from the TAPS. These were evaluated separately.

For the Alaska North Slope, all available information on historic spills greater than or equal to 100 bbl during 1968-2000 from industry and regulatory agencies (Hart Crowser, Inc., 2000; Anderson and LaBelle, 2000) was obtained and collated. The Minerals Management Services (MMS) and Hart Crowser, Inc. collected data for crude oil spills for the U.S. Beaufort Sea, the NPR-A, and Alaska Onshore North Slope east of the NPR-A from the following sources:

- BP Exploration (Alaska) Inc. electronic database files of oil spills in the Prudhoe Bay Unit Western Operating Area (1989 through 1996), Duck Island (Endicott) Unit (1989 through 1996), and Milne Point (1994 through 1996).
- BP Exploration (Alaska), Inc. electronic spreadsheet containing all Industry and contractor oil spills from January 1997 to May 2001.
- ARCO electronic spreadsheet files of oil spills for the Prudhoe Bay Unit Eastern Operating Area (1977 through 1996), Kuparuk River Unit (1977 through 1985 and 1986 through 1996), and Kuparuk River Unit exploration (1986 through 1996).
- Alyeska printed summary report of oil spills greater than 1,000 bbl along the TAPS from 1977-1989.
- Joint Pipeline Office electronic database of oil spills along the TAPS (1970 through 1994).
- Bureau of Land Management printed reports of oil spills along the TAPS during 1981 and 1982.
- State of Alaska, Department of Environmental Conservation (ADEC) electronic text and spreadsheet files of oil spills from the agency's current oil and hazardous substances spill database (July 1995-February 1997) and an earlier oil and hazardous substances spill database (1971-July 1995).
- ADEC electronic spreadsheet containing all oil spills in their current oil and hazardous substance spill

database to December 2000.

- An unattributed printed summary of oil spills over 378.5 liters (100 gallons) on Alaska's North Slope and along the TAPS from 1970-1981.
- An electronic spreadsheet summary of Alaskan and Canadian oil spills of 100 bbl or greater, from 1978 through 2000, as reported by the Oil Spill Intelligence Report.
- An MMS report that no oil spills of 100 bbl or larger have occurred in the Alaska Outer Continental Shelf Beaufort or Chukchi sea study area.
- Alyeska electronic spreadsheet file containing all oil spills of 100 bbl and greater from the company's oil-spill database to September 1999.
- ADEC electronic spreadsheet containing all oil spills in their current oil and hazardous substance spill database to December 2000.
- Additional oil-spill data were not received in response to inquiries and requests made by Hart Crowser, Inc. to the EPA, BLM, or the National Response Center.

A review of the reliability and completeness of the data for spills greater than or equal to 500 bbl (Hart Crowser, Inc., 2000) indicates that the available information was most reliable for 1985-2000, based on written documentation or lack of documentation and spills before that period. The MMS determined that spills greater than or equal to 100 bbl were documented and included in the database since 1985. In 1985, ADEC began tracking spills in an electronic format. Although Hart Crowser, Inc. (2000) states that the database is complete since production began, MMS prefers to use 1985 as the starting point of reliability. Any uncertainty in documenting spills before that time is a concern because it is typical for spills to occur more frequently during field and pipeline startup.

Six crude oil spills greater than or equal to 500 bbl associated with onshore or offshore Alaska North Slope oil production from 1985-2000 are listed in Table App 9-01. All of the crude oil spills of 500 bbl or greater occurred between 1989 and 2000. No spills greater than or equal to 1,000 bbl were documented during this time period. Of the six spills, one--a leak in either a 20- or 24-inch flow line from the wells in Kuparuk to the Central Processing Facility--is classified as a pipeline spill. The other five spills are classified as facility spills.

From 1985-2000, the median facility spill greater than or equal to 500 bbl on Alaska's North Slope is 663 bbl, and the mean (or average) is 680 bbl. The one pipeline spill has a volume of 510 bbl. For spill analysis, the largest recorded facility spill is used. The largest facility spill on record is 925 bbl. This analysis uses a pipeline spill of 510 bbl. Rounded to the nearest 100 (to reflect the uncertainty associated with spill estimates), the hypothetical spill sizes become 900 bbl for the facility spill and 500 bbl for the pipeline spill.

(2) Historical Crude Oil Spills Greater Than or Equal to 500 Barrels from the Trans-Alaska Pipeline

The TAPS oil-spill analysis includes the pipeline and the pump stations but excludes the Valdez marine terminal. Eight crude oil spills greater than or equal to 500 bbl associated with TAPS from 1977-2001 are identified in Table App 9-02. Most large crude oil spills were associated with the start-up of the pipeline. No large spills greater than or equal to 1,000 bbl occurred from 1981 to 2000. On October 4, 2001, a bullet punctured the 48-inch TAPS mainline and approximately 6,800 bbl of crude oil were released from this intentional sabotage. Using the highest reported spill-quantity values, the mean (average) recorded crude oil spill greater than or equal to 500 bbl from 1977-2001 is 5,462 bbl and the median is 4,381 bbl. Using the Alyeska Pipeline Service Company reported values, the mean and median spill sizes are 4,089 and 1,650 respectively. For spill analysis the highest reported spill quantity mean is used and rounded to the nearest 100. The mean hypothetical TAPS spill size is 5,500 bbl (median 4,400 bbl) for this analysis.

(3) Historical Crude Oil Spills Greater Than or Equal to 1, 000 Barrels from the Trans-Alaska Pipeline

The 11 crude oil spills greater than or equal to 1,000 bbl associated with the TAPS tankers from 1977 to 1999 are listed in Table App 9-03. The mean size for all TAPS tanker spills is 27,000 bbl and the median is 5,000 bbl. For in-port spills, the mean and median are 5,600 bbl and 5,300 bbl, respectively. For at-sea spills, the mean and median are 40,600 bbl and 4,900 bbl, respectively. TAPS tanker spills are smaller than worldwide tanker spills and slightly smaller than tanker spills in U.S. waters (Anderson and Labelle, 2000).

(4) Historical Crude Oil Spills From Blowouts on Alaska's North Slope

The record for Alaska North Slope blowouts is not validated, but is presented as the best available information. There are two written reports regarding blowouts on Alaska's North Slope: Mallory (1998) and Fairweather (2000). Fairweather (2000) found 10 blowouts, 6 that Mallory had identified and 4 that occurred before 1974. Of the 10 blowouts, 9 were gas and 1 was oil. The 1950 oil blowout was unspectacular and could not have been avoided, as there were no casings or blowout preventors available (Fairweather, 2000). These drilling practices from 1950 would not be relevant today. A third study confirmed that no crude oil spills greater than or equal to 100 bbl from blowouts occurred from 1985-1999 (Hart Crowser, Inc., 2000). A recent report titled *Blowout Frequency Assessment of Northstar* (Scandpower, 2001) uses statistical blowout frequencies modified to reflect specific field conditions and operative systems at Northstar. This report concludes that the blowout frequency for drilling the oil-bearing zone is 1.5 x 10^{-4} per well drilled. This compares to a statistical blowout frequency of 7.4 X 10^{-5} per well (for an average development well). This same report estimates the frequency of oil quantities per well drilled for Northstar for a spill greater than 130,000 bbl is 9.4 x 10^{-5}

However unlikely a blowout may be, because it is and important concern to the public, the effects of a 120,000 bbl (15 day) spill are analyzed in Section IV.J Low Probability, Very Large Oil Spill.

b. Historical Large Crude Oil Spill Rates

Oil spill rates are the number of spills that occur over some exposure variable. The exposure variable can be barrels of oil produced of pipeline miles per year. Oil spill rates are estimated for the Alaska North Slope, the Trans-Alaska pipeline and the Trans-Alaska pipeline tankers using historical spill data.

(1) Alaska North Slope Spill Rate 1985-2000 Based on Volume

Alaska North Slope facility and pipeline spills greater than or equal to 500 bbl from 1985-2000 are shown in Table App 9-01 (not including TAPS, which is analyzed separately). No spills greater than or equal to 1,000 bbl from Alaska North Slope production have occurred since 1985. Before 1985, no documentation for crude oil spills greater than or equal to 100 bbl was found, but spill records have not been validated as complete before 1985 because of missing or incomplete documentation.

As noted above, 5 facility spills and 1 pipeline spill are documented from 1985-2000. Total Alaska North Slope production was estimated to be 9.36 Bbbl of crude oil and condensate (Alyeska Pipeline Service Company, 2001;

McMaines, 2001). Anderson and LaBelle (2000) calculated Alaska North Slope spill rates from 1985-1998, hence the slight differences between the spill rates calculated from the 1985-2000 information for this EIS and those calculated by Anderson and LaBelle (2000). The spill rate of 0.53 spills/Bbbl handled for Alaska North Slope facility spills, greater than or equal to 500 bbl, was calculated for the entire record of five spills from 1985-2000. The MMS uses the 1985-2000 time period because spills greater than 100 bbl have been documented since 1985. In addition, the ADEC began an electronic database of oil spills in 1985. The MMS considers the database most reliable from 1985 forward. The Alaska North Slope pipeline spill rate of 0.11 spills/Bbbl handled for spills greater than or equal to 500 bbl was based on the record of 1 pipeline spill from 1985-2000. The combined spill rate for facilities and pipelines is 0.64 spills/Bbbl handled (Table App 9-04).

(2) Trans-Alaska Pipeline Spill Rate 1977-2001 and 1985-2001 Based on Volume and Pipeline-Mile-Year

The first flow in the TAPS began on June 20, 1977, with throughput of 112 million barrels of oil (MMbo) by the end of 1977. Throughput increased to almost 400 MMbo in 1978, peaked at 744 MMbo in 1988, and was 370 MMbo in 2001. The estimated volume transported through the TAPS from 1977-2001 is 13.62 Bbbl. The TAPS is 800.302 mi long.

(a) 1977-2001

The TAPS crude oil spills greater than or equal to 500 bbl are shown in Table App 9-02. There have been 12 crude oil spills (greater than or equal to 100 bbl) attributed to TAPS operation, 4 of which were greater than or equal to 100 bbl and less than 500 bbl. Eight spills were greater than or equal to 500 bbl, of which 6 were greater than or equal to 1,000 bbl. The last spill greater than or equal to 1,000 bbl occurred in 2001. The spill rate for spills greater than or equal to 500 bbl of 0.58 spills/Bbbl transported for TAPS was calculated based on the record of 6 accidental and 2 sabotage spills over 13.62 Bbbl of production. The spill rate of 0.000407 spills per pipeline-mile-year for TAPS (spills greater than or equal to 500 bbl) was calculated based on the record of 6 accidental and 2 sabotage spills over 18,835 pipeline-mile-years from 1977-2001.

(b) 1985-2001

For purposes of analysis, the same time period and class size corresponding to the North Slope data are used. The time period is 1985-2001 and the class size is greater than or equal to 500 bbl. The spill rate for spills greater than or equal to 500 bbl of 0.21 spills/Bbbl transported for TAPS was calculated based on 2 spills over 9.7 Bbbl of oil transported. The TAPS spill rate for spills greater than or equal to 500 bbl is 0.00015 spills per pipeline-mile-year. The rate was also calculated based on 2 spills over 13,605 pipeline-mile-years from 1985-2001.

(3) Trans-Alaska Pipeline Tanker Spill Rate 1977-1999 Based on Volume

The TAPS tanker crude oil spills greater than or equal to 1,000 bbl are shown in Table App 9-03. Eleven tanker spills occurred in association with the transportation of Alaska North Slope crude (Anderson and LaBelle, 2000). These 11 spills include the *Exxon Valdez* spill and 10 other spills less than or equal to 15,000 bbl. No large spills have occurred since 1991. The spill rate of 0.88 spills/Bbbl transported was calculated on the record of 11 accidental spills over 12.60 Bbbl of production (Anderson and LaBelle, 2000).

c. Estimated Mean Number and Probability of One or More Large Crude Oil Spills for the Northwest NPR

The mean number of large crude-oil spills estimated over the production life of the Northwest NPR-A Planning Area for the No Action Alternative, Alternatives A, B, and C, and the Preferred Alternative at the $18 and $30 per barrel price are shown in Table App 9-05. This mean number of spills is derived from the resource volume and the spill rate. The mean number of spills is zero for No Action and Alternative C at any price. The mean number of spills is zero for Alternatives A and Band the Preferred Alternative at the $18/bbl price and 0.47, 0.40 ,and 0.40 ,respectively ,at the $30/bbl price. For purposes of analysis under Alternatives A and B and the Preferred Alternative, no spills are assumed to occur at the $18/bbl price and one spill is assumed to occur at the $30/bbl price.

The mean spill number is used to estimate the percent chance of one or more spills occurring. There is a less than a 0.5 percent chance of one or more spills occurring for all alternatives at the $18/bbl price. There is a 33, 38, and 38 percent chance of one or more large spills occurring under Alternatives A and B and the Preferred Alternaitve, respectively, at the $30/bbl price. The most likely number of spills for all alternatives at either price is zero.

2. Probability of a Small Crude Oil Spill - Less Than 500 bbl

The effects of small spills (less than 500 bbl) are analyzed in this IAP/EIS in Section IV.B through IV.E and Section V. Two types of small spills--crude and refined oils--are considered.

A spill rate of approximately 618 spills/Bbbl handled calculated from the Alaska North Slope record of small spills is used here. Since the same companies and regulators will likely participate onshore in the Northwest NPR-A as those that now operate onshore the Alaska North Slope, it seems reasonable to assume that the rate in the Northwest NPR-A will be similar to the rate on the North Slope.

Historical oil spill information and simple statistical methods are used to derive the following information about small crude and refined oil spills that occur on the Alaska North Slope. This information includes estimates of:

- how often a spill occurs for every billion barrels of oil produced (oil-spill rates);
- the mean number of oil spills ;and
- the mean and median size of oil spills from facilities, pipelines, and flow lines combined.

This information is used to estimate the number, size, and distribution of operational small spills that may occur in the Northwest NPR-A Planning Area.

The historical information is crude and refined oil spills reported to ADEC and the Joint Pipeline Office (JPO) by the oil industry. Crude and refined oil spill rates and patterns from North Slope oil and gas exploration and development activities are determined for spills greater than or equal to 1 gallon and less than 500 bbl. Refined oil includes aviation fuel, diesel fuel, engine lubricants, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. The North Slope oil-spill analysis includes onshore and offshore oil and gas exploration and development spills from the Point Thompson Unit, Bedami Unit, Kuparuk River Unit, Milne Point Unit, Prudhoe Bay West Operating Area, Prudhoe Bay East Operating Area, and Duck Island Unit.

Oil spill information is provided to ADEC by private industry in accordance with State of Alaska Regulations, 18 AAC 75. The ADEC figures are based on initial spill reports and may not contain updated information. Because of increased scrutiny after the *Exxon Valdez* oil spill (Volt, 1997, pers. comm.), ADEC database integrity is most reliable from 1989 and after. Even though the database integrity cannot be validated thoroughly, the information is still valuable because it is the only available data regarding small spills. For this analysis, ADEC records were spot checked against spill records from ARCO Alaska and British Petroleum. All spills greater than or equal to 1 gallon and less than 500 bbl are included. The time period used for this analysis was January 1989-December 2000. A simple analysis of operational small oil-spills is performed. Spill rates are estimated without regard to differentiating operation processes. The ADEC database structure does not facilitate quantitative analysis of North Slope oil spill rates separately for platforms, pipelines, or flow lines without further documentation and validation.

a. Historical Small Crude Oil Spill Rates and Patterns on Alaska's North Slope

As this analysis of crude oil spills is performed collectively for all North Slope facilities, pipelines, and flow lines, the pattern that emerges is one of numerous small spills. Of the crude oil spills that occurred between 1989 and 2000:

- 31 percent were less than or equal to 2 gallons;
- 55 percent were less than or equal to 5 gallons;
- 98 percent were less than 25 bbl; and
- 99 percent were less than 60 bbl.

The small spill sizes in the database range from less than 1 gallon to 425 bbl. The mean crude oil-spill size on the Alaska North Slope is 2.7 bbl, and the median spill size is 5 gallons. For purposes of analysis, this IAP/EIS assumes a mean crude oil-spill size of 3 bbl.

Causes of small crude oil spills on the North Slope, in decreasing order of frequency, are:

1. leaks,
2. faulty valve/gauges,
3. vent discharges,
4. faulty connections,
5. ruptured lines,
6. seal failures,
7. human error, and
8. explosions.

Approximately 30 percent of the spills have unknown causes. The estimated crude oil spill rate for the North Slope is 178 spills/Bbbl produced, as indicated in Table App 9-04. The mean number, size, and total volume of small spills for each of the Northwest NPR-A alternatives are shown in Table App 9-06. For this analysis, the mean number of small spills is used as the assumed number of spills. The assumed size distribution of those spills for each of the alternatives is shown in Table App 9-07.

b. Historical Small Refined Oil Spill Rates and Types of Spills on Alaska's North Slope

The typical refined products spilled are aviation fuel, diesel fuel, engine lube, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. Diesel spills represent 58 percent of refined oil spills by frequency and 83 percent by volume. Engine lube oil spills are 10 percent by frequency and 3 percent by volume. Hydraulic oil is 26 percent by frequency and 10 percent by volume. All other categories are less than 1 percent by frequency and volume. Refined oil spills occur in conjunction with oil exploration and production. Refined oil spills correlate to the volume of North Slope crude oil produced. As production of crude oil has declined, so has the number of refined oil spills. This could be a coincidence, as emphasis on pollution prevention has increased in the last several years. From January 1989 to December 2000, the spill rate for refined oil was 440 spills/Bbbl produced, as shown in Table App 9-08 . The mean number of refined oil spills during the lifetime of the alternatives is shown in Table App 9-09 .

3. Probability of a Very Large Oil Spill - Greater Than or Equal to 120,000 Barrels

Very large spill size assumptions for Northwest NPR-A facilities and pipelines are based on response planning standards and discharge estimates for Alpine (ARCO Alaska, 1999; Phillips, 2001). Blowouts are unlikely events. While blowouts are often equated with catastrophic spills, very few blowout events have resulted in spilled oil, and the volumes that are spilled are often small.

B. Oil Weathering and Spreading

Information about oil weathering and the areal extent of an oil spill are estimated from oil weathering models and historical information.

1. Modeling Simulations of Oil Weathering

To judge the effect of an oil spill, the following volumes must be estimated: how much oil evaporates; how much oil is dispersed; and how much oil remains after a certain time period. Alpine crude oil is used as the analog of oil types in the Northwest NPR-A Planning Area. Weathering estimates of Alpine crude oil and arctic diesel (over a 30-day period) are derived by the SINTEF Oil Weathering Model (OWM), Version 2.0 (Reed et al., 2000).

Individual weathering results for Alpine crude oil spills from the SINTEF OWM model are shown in Tables App 9-10 and App 9-11. The SINTEF OWM changes both oil properties and physical properties of the oil. The oil properties include density, viscosity, pour point, flash point, and water content. The physical processes include spreading, evaporation, oil-in-water dispersion, and water uptake. The OWM performs a 30-day time horizon on the model weathering calculations, but with a warning that the model is not verified against experimental field data for more than 4 to 5 days. The SINTEF OWM has been tested extensively with results from three full-scale field trials of experimental oil spills (Daling and Strom, 1999).

The SINTEF OWM does not incorporate the effects of:

- currents;
- beaching;

- containment;
- photo-oxidation;
- microbiological degradation;
- adsorption to particles; and
- encapsulation by ice.

The spill sizes chosen for oil weathering are 500 and 900 bbl for the Alpine-type crude oil spill and 900 bbl for a diesel spill. Two general scenarios were simulated: one in which oil spills into open water, and another in which oil freezes into the ice and melts into 50 percent ice cover. Open water is assumed to occur July through September, and a winter spill melts out in July. For open water, the weathering of the 500- and 900-bbl spills is modeled as instantaneous spills. For the meltout spill scenario, the entire spill volume is modeled as an instantaneous spill. Although different amounts of oil could melt out at different times, MMS assumed a conservative approach--all oil was released at the same time. Results are reported for the end of 1, 3, 10, and 30 days. The assumed fate and behavior of Alpine crude oil and diesel oil in the analysis of the effects of oil on environmental and social resources are summarized in Tables App 9-10 and App 9-11.

2. Observations of Historic North Slope Spill Patterns

The scenarios for Alternatives A and B and the Preferred Alternative include an onshore pipeline. Of greatest concern would be the possible contamination of the Colville River, because a pipeline may cross or underlie the Colville and some of its tributaries. The State of Alaska, Department of Environmental Conservation (ADEC) Alaska North Slope database structure does not facilitate a quantitative analysis of pipeline spill rates for small spills. The ADEC database specifically identifies 5 pipeline leaks among 975 spill records. The volumes of these pipeline leaks are 0.7, 5, 18, 125, and 510 bbl. Those spills occurring or moving off pads may have some potential to enter a river or waterbody. For purposes of analyses, the percent of crude-oil spills occurring on a pad versus off the pad and onto the surrounding environment is estimated. Approximately 65 to 80 percent of all crude-oil spills occur on a pad and have little or no effect on the environment. Approximately 20 to 35 percent may occur on or reach the surrounding environment.

Those spills reaching the surrounding environment generally remain restricted to a limited area of the tundra unless they reach a river, stream, or other waterbody. The ADEC records are not accurate enough to provide statistical spill size areas. The following are comments based on the ADEC database and Behr-Andres et al. (2001). Off-pad spills that occur or reach the environment generally cover a small area ($\leq$ 500 ft^2). Larger contamination areas occur when wind blows a fine oil mist over a large area. The largest area ever covered was from a pipeline spill on December 30, 1993, at drill site 5, well 23, which misted a fine oil spray of 4 bbl over a tundra area of 100 to 145 acres (Mueller, 1997, pers. comm.). Crude oil from a failed flowline spilled onto a gravel pad, reserve pit and impoundment. High winds resulted in the crude oil being misted over the snow-covered tundra in an area approximately 330 ft wide and 1,300 ft long (Behr-Andres et al., 2001). Of the off-pad spills that occur, many contact snow or ice, which is cleaned up before the oil reaches the tundra. Spills less than 360 are likely to be contained within the snow layer, depending on snow depth and density. Larger spills are more likely to reach the ground surface (Behr-Andres et al., 2001). The ADEC database documents that a spill at Point McIntyre covered approximately 23 acres of snow-covered tundra with 142 bbl of crude oil. Because this area was snow covered, there was little impact to the surrounding environment. If this spill had occurred during the summer, the impacts would have been very different.

C. Cumulative Analysis of Oil Spills

This section discusses how the oil spills for the cumulative analysis (Sec. IV.F) were estimated.

1. Preparing the Cumulative Analysis

The TAPS pipeline, onshore North Slope, TAPS tankers, and the Alaska Outer Continental Shelf have varying spill rates and spill-size categories. For a summary of spill rates and spill size categories that were assumed for analysis of oil spills in the cumulative case, see Table App 9-12. One factor to keep in mind is that most oil originating from either onshore or offshore on the North Slope of Alaska flows through the TAPS pipeline and into TAPS tankers.

Estimates of past, present, and reasonably foreseeable production are used for the quantitative analysis of oil spills. The resource and reserve figures used to estimate oil spills for the cumulative case are shown in Table App 9-13. Past, present, and reasonably foreseeable production contributes 10.68 Bbbl in reserves and resources, with the Northwest NPR-A contributing an additional 0.37 Bbbl (the mean resource value for the Northwest NPR-A Planning Area) for a total of 11.05 Bbbl.

2. Estimating Possible Future Spills from All Sources

The estimated mean number and volume of spills for the cumulative case are shown in Table App 9-14. It is unlikely that projects in the Northwest NPR-A would result in an oil spill in the Beaufort Sea, onshore or along the TAPS pipeline or tanker route. Thus, for purposes of analysis of the cumulative case, it is assumed the Northwest NPR-A would not contribute an oil spill offshore in the Beaufort Sea, onshore, or along the TAPS pipeline or tanker route.

The pipeline and platform spill size in the Beaufort Sea ranges from 1,500 to 4,600 bbl. The onshore spill size range is 500 to 900 bbl. For the cumulative case, a TAPS pipeline spill of 4,400 bbl is estimated (average spill size from TAPS tankers are discussed below.)

No spills greater than or equal to 1,000 bbl are estimated (see Table App 9-14) from activities in the Beaufort Sea over the lifetime of Northwest NPR-A Planning Area projects. These estimates are based on production from past, present, and reasonably foreseeable developement. Possible offshore sources in these categories include Endicott, Northstar, Kalubik, Gwydyr Bay, Flaxman Island, Liberty, Kuvlum, and Hammerhead. This category also includes potential production from undiscovered resources on federal leased tracts in the Beaufort Sea.

Table App 9-14 shows two estimated spills greater than or equal to 500 bbl from the TAPS pipeline but as a result of other projects, though it is unlikely that Northwest NPR-A Planning Area projects would be one of them.

Table App 9-14 also lists an estimated 9 spills greater than or equal to 1,000 bbl from projects other than Northwest NPR-A Planning Area along the TAPS tanker route. Table App 9-03 shows the 11 historical tanker spills along the TAPS tanker route from 1977 to 1999. The information from Table App 9-03 was used to estimate the size and location (in port or at sea) of the 9 assumed spills.

The estimated sizes of the 9 spills are indicated in Table App 9-15 :

- 6 spills–4 in port and 2 at sea–with a mean size of 4,000 bbl;
- 2 spills at sea with a mean size of 13,000 bbl; and
- 1 spill at sea ranging from 200,000 to 260,000 bbl (for purposes of analysis 250,000 bbl).

Previous studies show that the chance of one or more spills both occurring and contacting land along the U.S. coast adjacent to the TAPS tanker route is less than or equal to 3 percent (LaBelle et al., 1996).

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Endangered [illegible]
Species [illegible]
Conservation

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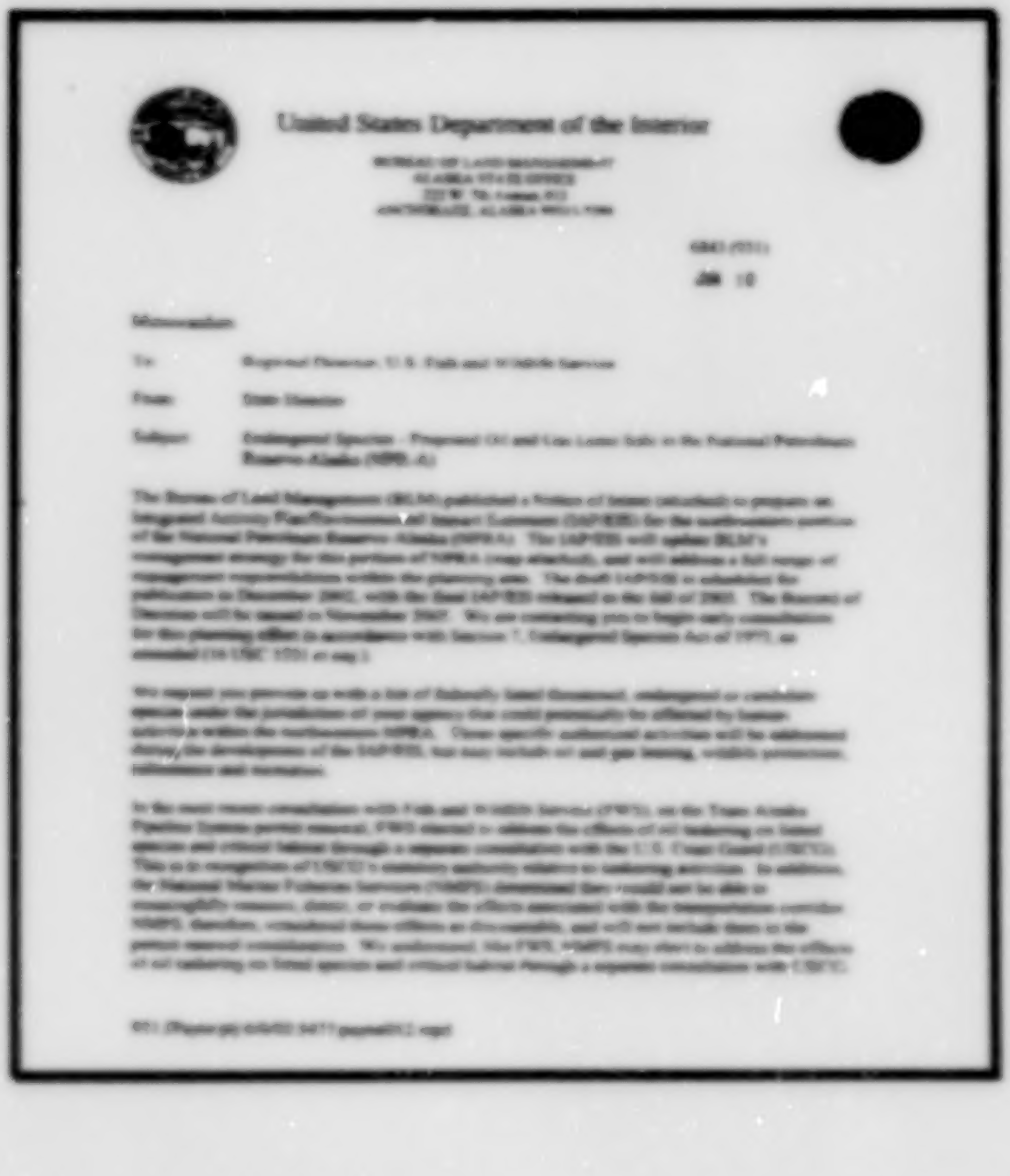
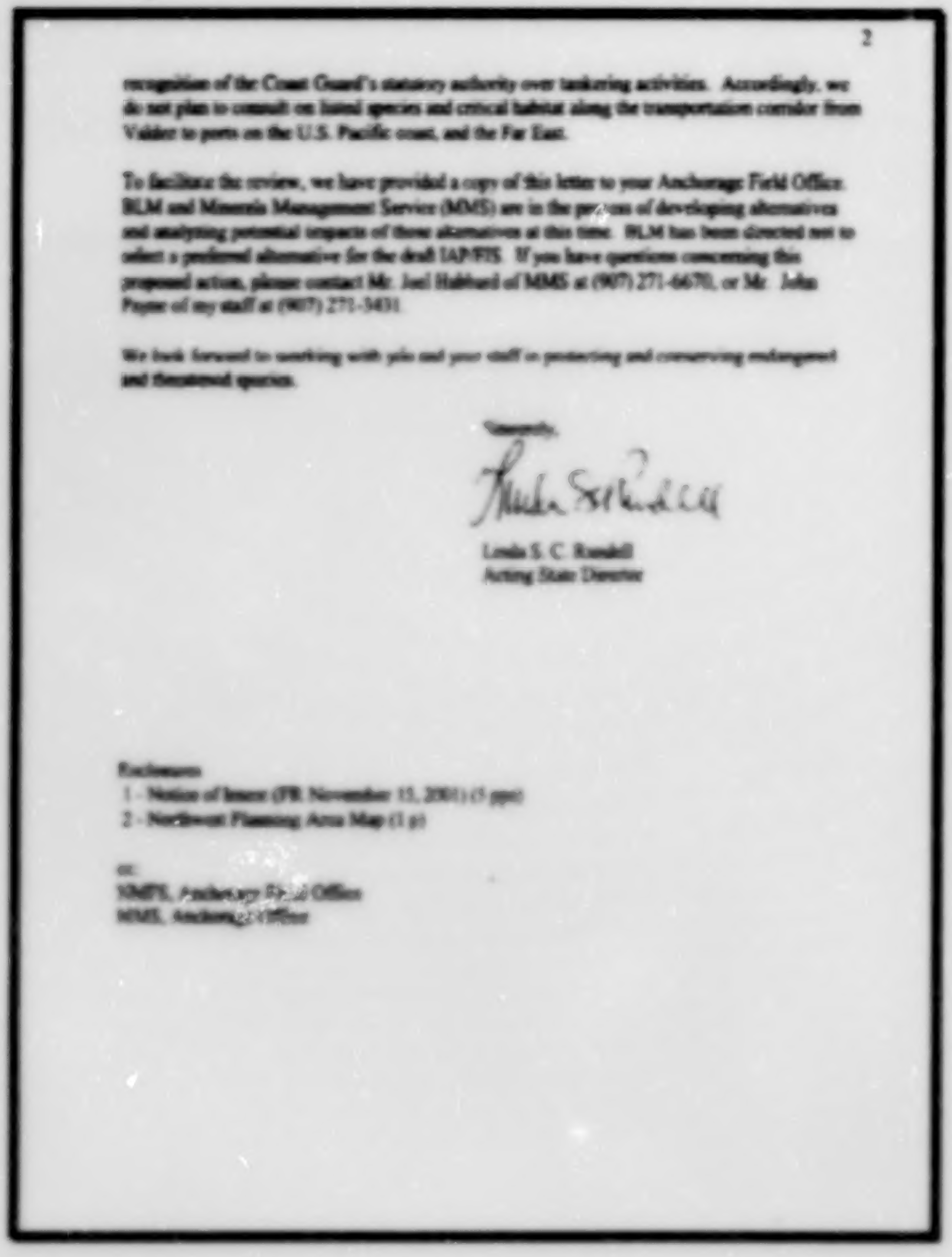
APPENDIX 10. THREATENED AND ENDANGERED SPECIES CONSULTATION



United States Department of the Interior



recognition of the Coast Guard's statutory authority over tankering activities. Accordingly, we do not plan to consult on listed species and critical habitat along the transportation corridor from Valdez to ports on the U.S. Pacific coast, and the Far East.

To facilitate the review, we have provided a copy of this letter to your Anchorage Field Office. BLM and Minerals Management Service (MMS) are in the process of developing alternatives and analyzing potential impacts of those alternatives at this time. BLM has been directed not to select a preferred alternative for the draft IAP/EIS. If you have questions concerning this proposed action, please contact Mr. Joel Hubbard of MMS at (907) 271-6670, or Mr. John Payne of my staff at (907) 271-3431.

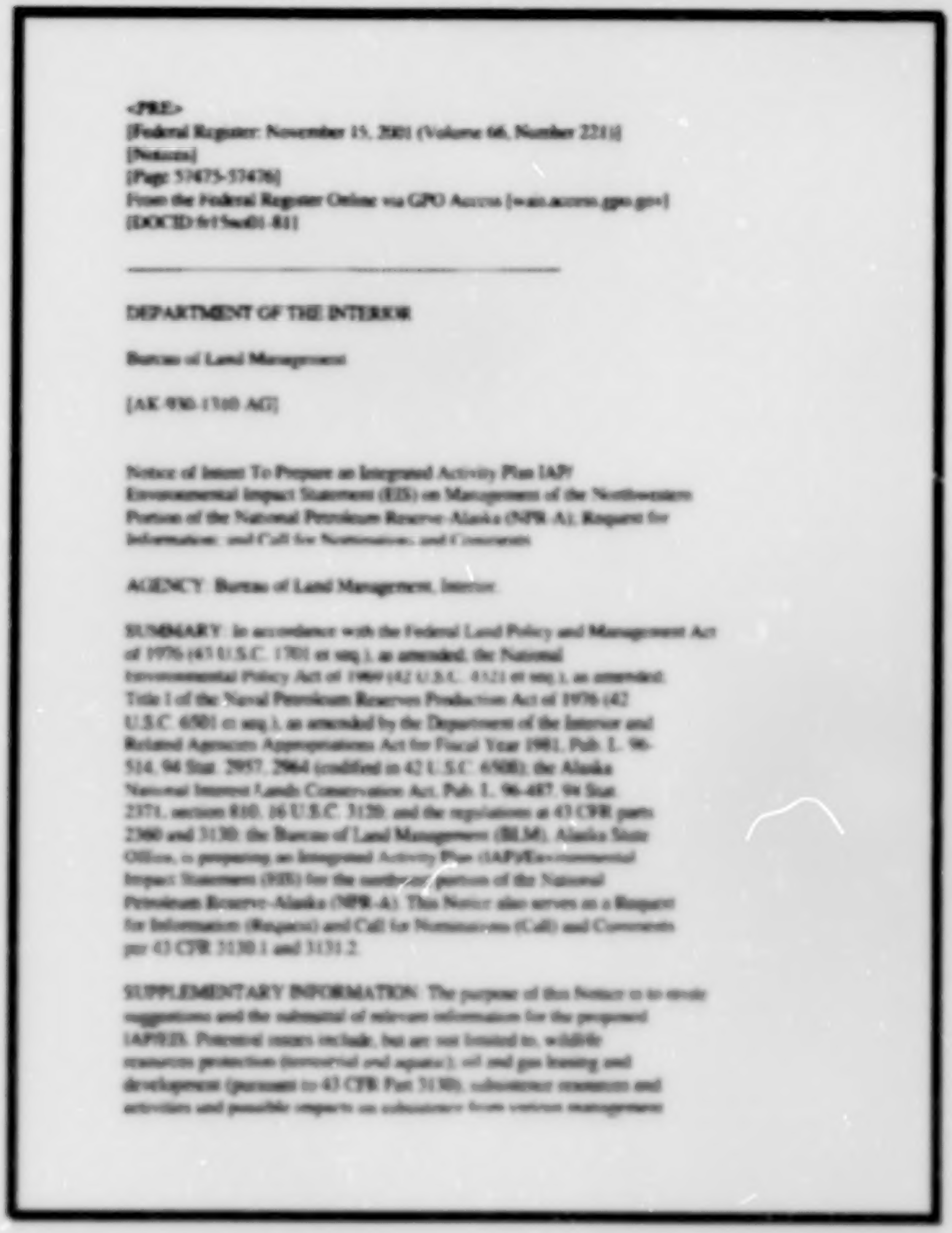
We look forward to working with you and your staff in protecting and conserving endangered and threatened species.

Sincerely,

Linda S. C. Rundell
Acting State Director

Enclosures
1 - Notice of Intent (FR November 15, 2001) (5 pgs)
2 - Northwest Planning Area Map (1 p)

cc:
NMFS, Anchorage Field Office
MMS, Anchorage Office



<PRE>
[Federal Register: November 15, 2001 (Volume 66, Number 221)]
[Notices]
[Page 57475-57476]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr15no01-81]

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[AK-930-1310-AG]

Notice of Intent To Prepare an Integrated Activity Plan IAP/ Environmental Impact Statement (EIS) on Management of the Northwestern Portion of the National Petroleum Reserve-Alaska (NPR-A); Request for Information; and Call for Nominations and Comments

AGENCY: Bureau of Land Management, Interior.

SUMMARY: In accordance with the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.), as amended; the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.), as amended; Title I of the Naval Petroleum Reserves Production Act of 1976 (42 U.S.C. 6501 et seq.), as amended by the Department of the Interior and Related Agencies Appropriations Act for Fiscal Year 1981, Pub. L. 96-514, 94 Stat. 2957, 2964 (codified in 42 U.S.C. 6508); the Alaska National Interest Lands Conservation Act, Pub. L. 96-487, 94 Stat. 2371, section 810, 16 U.S.C. 3120; and the regulations at 43 CFR parts 2360 and 3130; the Bureau of Land Management (BLM), Alaska State Office, is preparing an Integrated Activity Plan (IAP)/Environmental Impact Statement (EIS) for the northwest portion of the National Petroleum Reserve-Alaska (NPR-A). This Notice also serves as a Request for Information (Request) and Call for Nominations (Call) and Comments per 43 CFR 3130.1 and 3131.2.

SUPPLEMENTARY INFORMATION: The purpose of this Notice is to invite suggestions and the submittal of relevant information for the proposed IAP/EIS. Potential issues include, but are not limited to, wildlife resources protection (terrestrial and aquatic); oil and gas leasing and development (pursuant to 43 CFR Part 3130); subsistence resources and activities and possible impacts on subsistence from various management alternatives; access, recreation, and visual resources; threatened and endangered species; and historic, cultural, soil, water, and vegetation resources. Potential management actions and activities which may have environmental and subsistence impacts for the area include mineral material extraction, oil and gas exploration and development; wilderness; recreation; commercial development; recommendations for wilderness designations; modifications of existing Special Areas; and identification of any new areas for additional resource protection. Information, comments, and nominations on specific issues to be addressed in the plan are sought from all interested parties. This early planning and consultation step is important for ensuring that all interests and concerns are communicated to the Department of the Interior for future decisions in land use, planning, and management.

Description of the Area

The area subject to this Notice is composed of those BLM-administered lands, subject to valid existing rights, in the northwestern portion of NPR-A. The northwestern portion of NPR-A is *described as: Beginning on the western boundary NPR-A on the east–west* township line between T. 8 N., R. 40 W., and T. 9 N., R. 39 W., Umiat Meridian (UM.); Thence proceed easterly along the township line to the northeast corner of T. 8 N., R. 26 W., UM.; Thence proceed southerly along the township line to the southeast corner of T. 7 N., R. 26 W., UM.; Thence proceed easterly along the township line to the northeastern corner of T. 6 N., R. 25 W., UM.; Thence proceed southerly along the township line to the southeast corner of T. 5 N., R. 25 W., UM.; Thence proceed easterly along the township line to the northeast corner of T. 4 N., R. 24 W., UM.; Thence proceed southerly along the township line to the southeast corner of T. 1 N., R. 24 W., UM.; Thence proceed easterly along the township line to the northeast corner of T. 1 S., R. 24 W., UM.; Thence proceed southerly along the township line to the southeast corner of T. 4 S., R. 24 W., UM.; Thence proceed easterly along the township line to a point where the left bank of the Colville River meets the southern township line of T. 4 S., R. 15 W., UM.; Thence proceed in a generally easterly direction following the left bank of the Colville River to a point where the Colville River intercepts the eastern boundary of T. 3 S., R. 6 W., UM.; Thence proceed northerly following the township lines to the northeast corner of T. 2 N., R. 6 W., UM.; Thence proceed westerly following the township line to the right bank of the Ikpikpuk River on the south township line of T. 3 N., R. 12 W., UM.; Thence proceed northerly along the right bank of the Ikpikpuk River to the northern boundary of NPR-A; Thence follow the boundary of NPR-A in a general westerly and then southerly direction to the point of beginning of this description. This planning area consists of

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approximately 9,980,000 acres of which approximately 9,437,000 are federal and approximately 543,000 acres are in private ownership. A large scale map of the plan area (which also serves as the Call map) showing boundaries of the area by township is available from the Alaska State Office, BLM, 222 West 7th Avenue, Anchorage, AK 99501, telephone (907) 271-5546.

Public Participation

BLM seeks information and comments on issues relating to the future land use, planning, and management of the northwest portion of NPR-A. Also requested is information and comments on resources, such as wilderness, wildlife and subsistence resources, as well as current and potential future activities on these lands, including possible development of the area's oil and gas potential. The agency is interested in learning what areas are of particular value for various species and uses, and what measures should be considered to protect resources and uses from potentially impacting activities. Comments are also sought on any potential conflicts with approved coastal management plans (CMPs) and other land use plans that may result from possible future activities in the area. These comments should identify specific policies of concern as listed in CMPs or other plans, the nature of the conflicts foreseen, and steps that BLM could take to avoid or mitigate the potential conflicts. Comments may be in terms of broad areas or focused on particular townships of concern. Comments are sought on activities and measures to protect surface resources within the plan area, including fish and wildlife, historical and scenic values. Comments are sought on subsistence uses and needs within the plan area and possible impacts on subsistence from other uses of the area. Comments should include recommendations for particular

[[Page 57476]]

sections of the plan area that are of value for surface and subsurface resources, as well as conditions, restrictions, and prohibitions that would protect surface resources. Comments, including names and street addresses of respondents, will be available for public review during regular business hours. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be available for public inspection in their entirety.

Pursuant to 43 CFR 3131.1 and 3131.2, relevant information related to possible oil and gas leasing is requested for the plan area. Oil and gas companies are specifically requested to nominate areas within the plan area that they would like to have considered for oil and gas leasing. Nominations must be depicted on the Call map by outlining the area(s) of interest along township lines. Nominators are asked to submit a list of townships nominated to facilitate correct interpretation of their nominations on the Call map. Although the identities of those submitting nominations for oil and gas leasing become a matter of public record, the individual nominations will be held confidential consistent with applicable law. Nominators also are requested to rank townships nominated for oil and gas leasing according to priority of interest [(e.g., priority 1 (high), 2 (medium), or 3 (low)]. Townships nominated that *do not* indicate priorities will be considered priority 3. Nominators are encouraged to be specific in indicating townships by priority. Blanket priorities on large areas are not useful in the analysis of industry interest. The telephone number and name of a person to contact in the nominator's organization for additional information should be included in the response. The regulations at 43 CFR part 3130 limit the size of an oil and gas lease tract within the NPR-A boundaries to no more than 60,000 acres (43 CFR 3130.4-1). Although nominations are to be submitted along township lines, comments are also being sought on the preferred size of tracts for leasing in this area, not to exceed 60,000 acres.

Responses to this request for information and comments, and call for nominations must be received no later than 45 days following publication of this document in the Federal Register. Nominations must be submitted in envelopes labeled "Nominations Related to the NPR-A IAP/EIS" to protect the confidentiality of the nominations. The original Call map with nominations must be submitted to the NPR-A Planning Team Leader, Bureau of Land Management, 222 West 7th Avenue #13, Anchorage, AK 99513-7599. Information, comments, and nominations submitted in response to this publication will assist in early scoping and later development of alternatives for the IAP/EIS and will help identify areas for potential activities, including oil and gas development and resource protection.

Tentative Schedule

Approximate dates for actions and decisions in the planning process for this proposal are:

Comments are due on Notice, Request, and Call--December 15, 2001.

Scoping meetings are scheduled for the following Alaska communities:

Point Lay–December 3, 2001
Anaktuvuk Pass–December 4, 2001
Wainwright–December 5, 2001
Atqasuk–December 6, 2001
Barrow–December 10, 2001
Nuiqsut–December 11, 2001
Fairbanks–January 15, 2002
Anchorage–January 16, 2002

All meetings will begin at 7:00 PM. Meeting locations will be announced later.
Draft IAP/EIS available for comment–November 19, 2002.
Public meetings/hearings–December, 2002–January, 2003.
Comments due on Draft IAP/EIS–January 30, 2003.
Final IAP/EIS available for public view–October 2, 2003.
Record of Decision–November 3, 2003.

FOR FURTHER INFORMATION CONTACT: Curt Wilson, (907) 271-5546 or <A HREF="mailto:cwilson@ak.blm.gov">cwilson@ak.blm.gov</A>. He can be reached by mail at 222 W. 7th Avenue,
#13, Anchorage, AK 99513-7599.

Francis R. Cherry, Jr.,
State Director, Alaska.
[FR Doc. 01-28665 Filed
11-14-01; 8:45 am]
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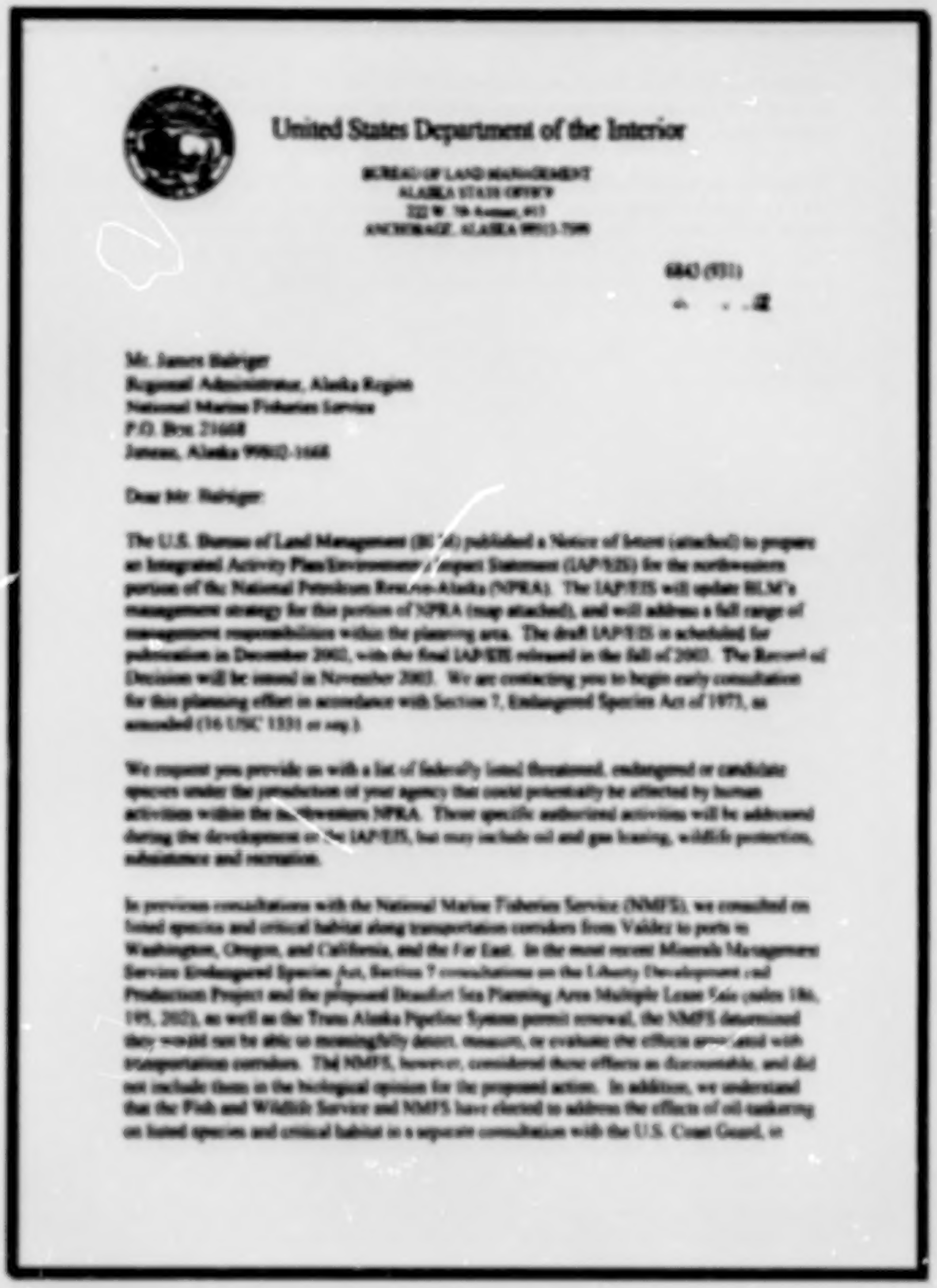

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ALASKA STATE OFFICE
222 W. 7th Avenue, #13
ANCHORAGE, ALASKA 99513-7599

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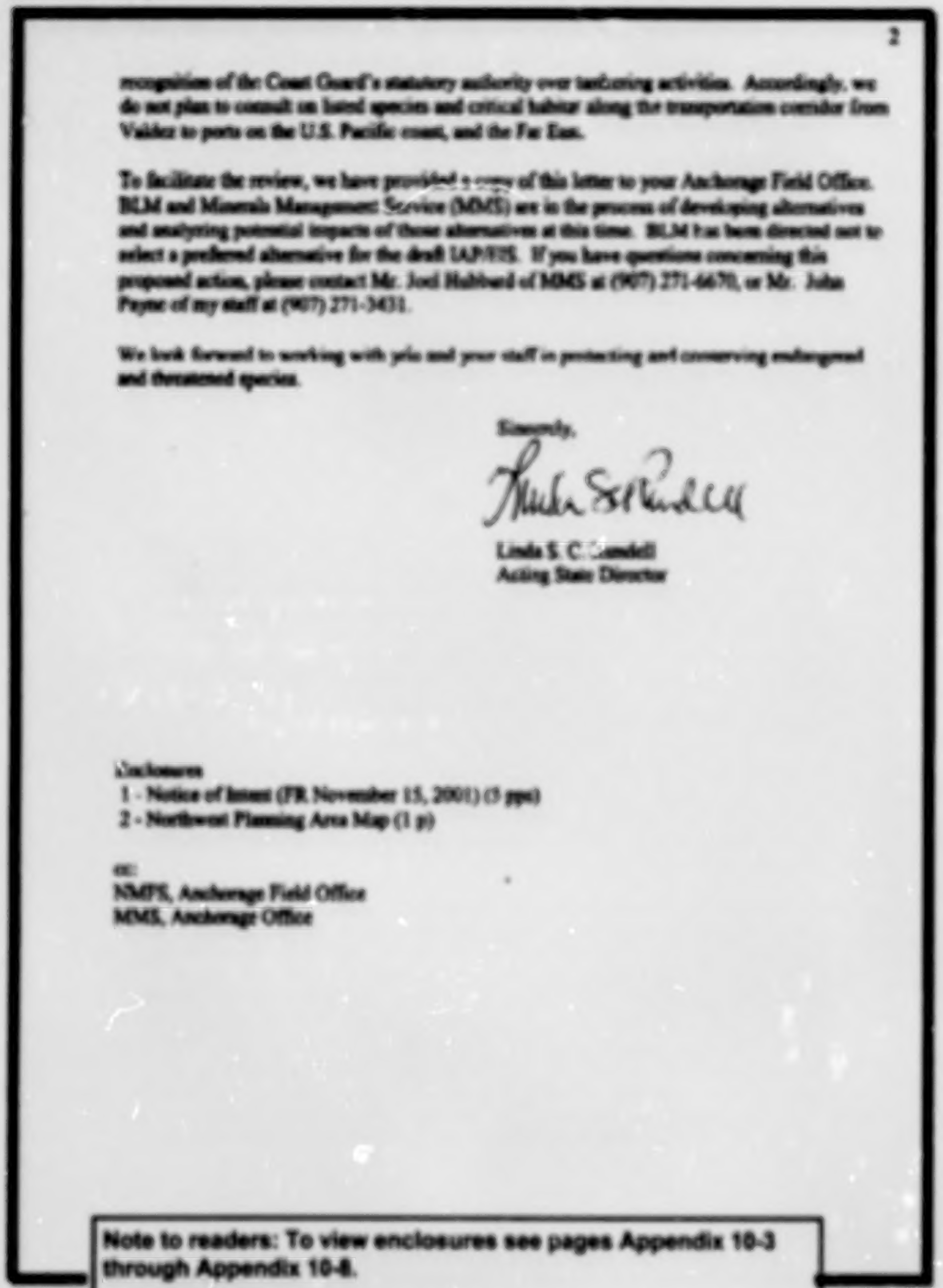
Mr. James Balsiger
Regional Administrator, Alaska Region
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Dear Mr. Balsiger:

The U.S. Bureau of Land Management (BLM) published a Notice of Intent (attached) to prepare an Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the northwestern portion of the National Petroleum Reserve-Alaska (NPRA). The IAP/EIS will update BLM's management strategy for this portion of NPRA (map attached), and will address a full range of management responsibilities within the planning area. The draft IAP/EIS is scheduled for publication in December 2002, with the final IAP/EIS released in the fall of 2003. The Record of Decision will be issued in November 2003. We are contacting you to begin early consultation for this planning effort in accordance with Section 7, Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*).

We request you provide us with a list of federally listed threatened, endangered or candidate species under the jurisdiction of your agency that could potentially be affected by human activities within the northwestern NPRA. These specific authorized activities will be addressed during the development of the IAP/EIS, but may include oil and gas leasing, wildlife protection, subsistence and recreation.

In previous consultations with the National Marine Fisheries Service (NMFS), we consulted on listed species and critical habitat along transportation corridors from Valdez to ports in Washington, Oregon, and California, and the Far East. In the most recent Minerals Management Service Endangered Species Act, Section 7 consultations on the Liberty Development and Production Project and the proposed Beaufort Sea Planning Area Multiple Lease Sale (sales 186, 195, 202), as well as the Trans Alaska Pipeline System permit renewal, the NMFS determined they would not be able to meaningfully detect, measure, or evaluate the effects associated with transportation corridors. The NMFS, however, considered these effects as discountable, and did not include them in the biological opinion for the proposed action. In addition, we understand that the Fish and Wildlife Service and NMFS have elected to address the effects of oil tankering on listed species and critical habitat in a separate consultation with the U.S. Coast Guard, in



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recognition of the Coast Guard's statutory authority over tankering activities. Accordingly, we do not plan to consult on listed species and critical habitat along the transportation corridor from Valdez to ports on the U.S. Pacific coast, and the Far East.

To facilitate the review, we have provided a copy of this letter to your Anchorage Field Office. BLM and Minerals Management Service (MMS) are in the process of developing alternatives and analyzing potential impacts of those alternatives at this time. BLM has been directed not to select a preferred alternative for the draft IAP/EIS. If you have questions concerning this proposed action, please contact Mr. Joel Hubbard of MMS at (907) 271-6670, or Mr. John Payne of my staff at (907) 271-3431.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species.

Sincerely,

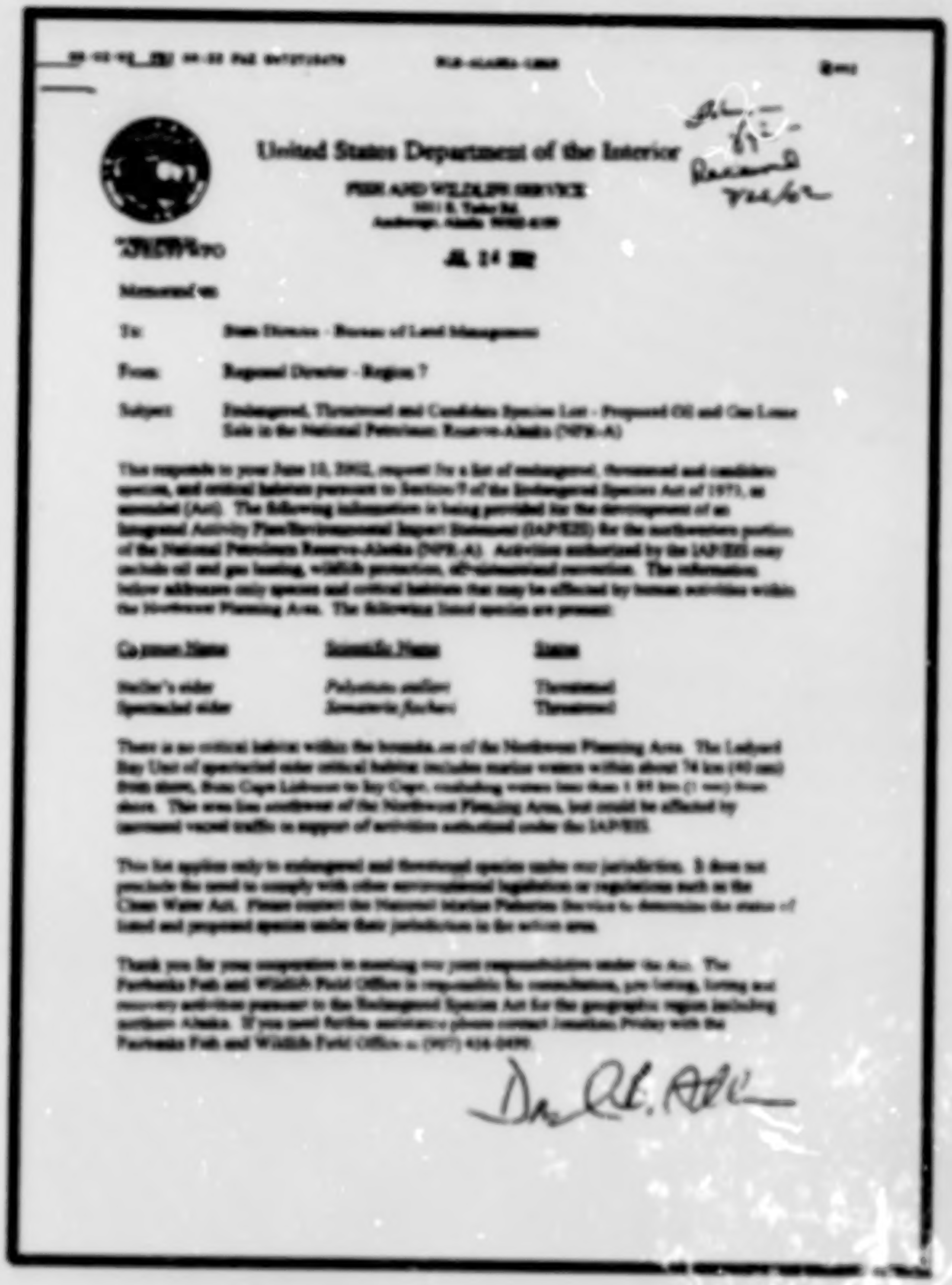
Linda S Rundell

Linda S. C. Rundell
Acting State Director

Enclosures
1 - Notice of Intent (FR November 15, 2001) (5 pps)
2 - Northwest Planning Area Map (1 p)

cc:
NMFS, Anchorage Field Office
MMS, Anchorage Office

Note to readers: To view enclosures see pages Appendix 10-3 through Appendix 10-8.



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United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska [illegible]

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Memorandum

To: State Director - Bureau of Land Management

From: Regional Director - Region 7

Subject: Endangered, Threatened and Candidate Species List - Proposed Oil and Gas Lease Sale in the National Petroleum Reserve-Alaska (NPR-A)

This responds to your June 10, 2002, request for a list of endangered, threatened and candidate species, and critical habitat pursuant to Section 7 of the Endangered Species Act of [illegible], as amended (Act). The following information is being provided for the development of an Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the northwestern portion of the National Petroleum Reserve-Alaska (NPR-A). Activities authorized by the IAP/EIS may include oil and gas leasing, wildlife protection, [illegible] recreation. The information below addresses only species and critical habitat that may be affected by human activities within the Northwest Planning Area. The following listed species are present:

Common Name	Scientific Name	Status
Steller's eider	*Polysticta stelleri*	Threatened
Spectacled eider	*Somateria fischeri*	Threatened

There is no critical habitat within the boundaries of the Northwest Planning Area. The Ledyard Bay Unit of spectacled eider critical habitat includes marine waters within about 74 km (40 nmi) from shore, from Cape Lisburne to Icy Cape, excluding waters less than 1.85 km (1 nmi) from shore. This area lies southwest of the Northwest Planning Area, but could be affected by increased vessel traffic in support of activities authorized under the IAP/EIS.

This list applies only to endangered and threatened species under our jurisdiction. It does not preclude the need to comply with other environmental legislation or regulations such as the Clean Water Act. Please contact the National Marine Fisheries Service to determine the status of listed and proposed species under their jurisdiction in the action area.

Thank you for your cooperation in meeting our joint responsibilities under the Act. The Fairbanks Fish and Wildlife Field Office is responsible for consultation, pre-listing, listing and recovery activities pursuant to the Endangered Species Act for the geographic region including northern Alaska. If you need further assistance please contact [illegible] with the Fairbanks Fish and Wildlife Field Office at (907) [illegible].

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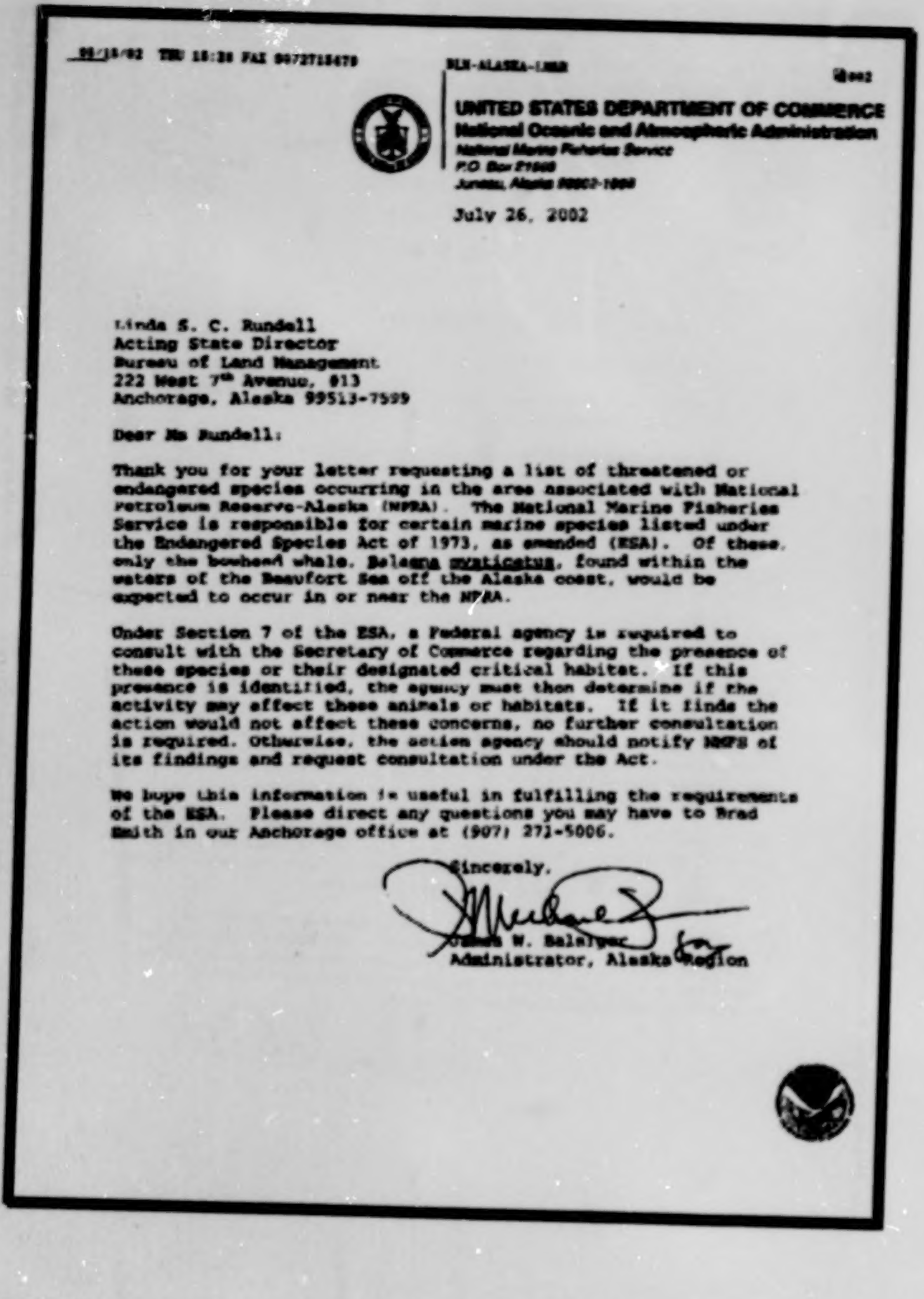


UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

July 26, 2002

Linda S. C. Rundell
Acting State Director
Bureau of Land Management
222 West 7th Avenue, #13
Anchorage, Alaska 99513-7599

Dear Ms Rundell:

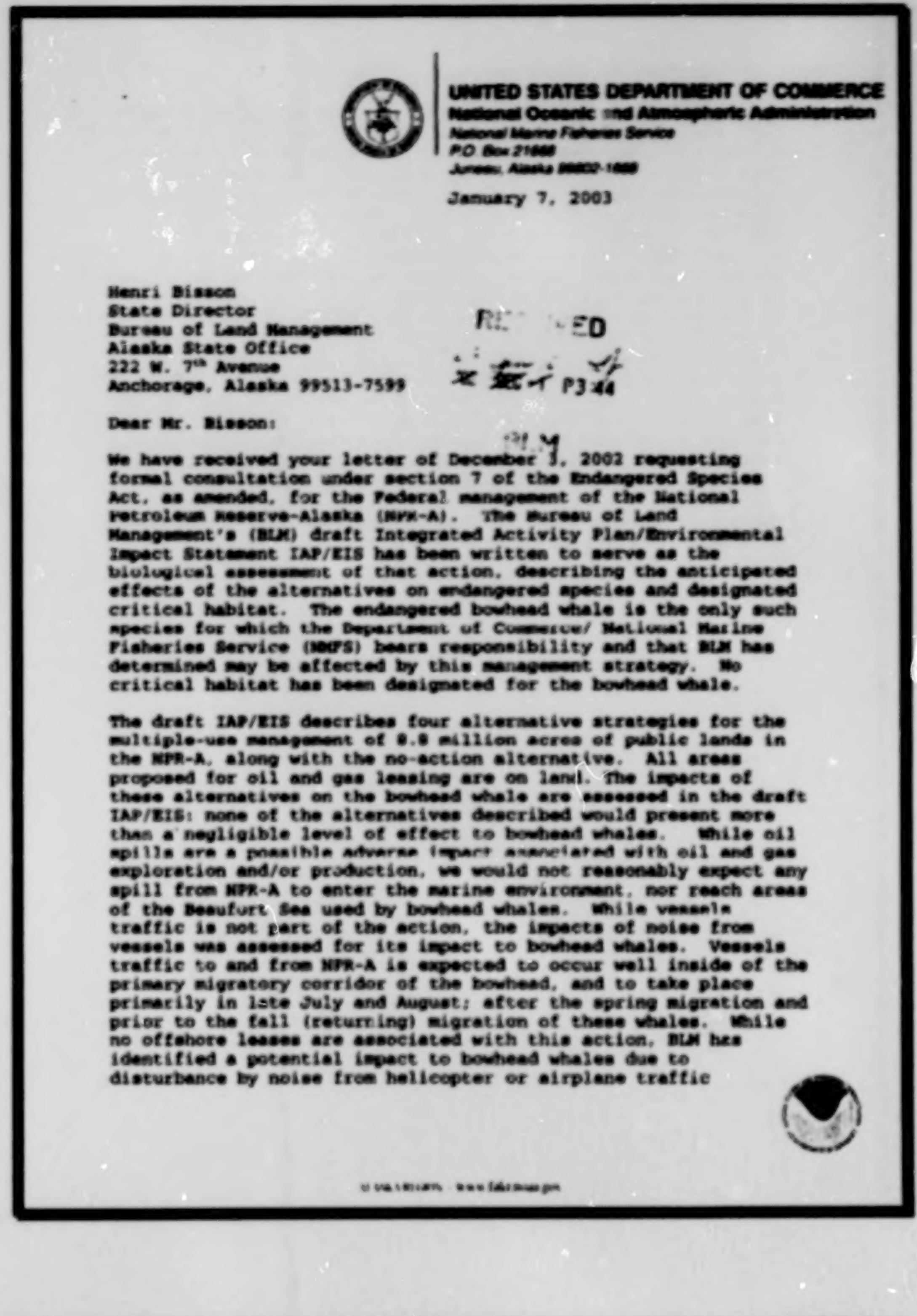
Thank you for your letter requesting a list of threatened or endangered species occurring in the area associated with National Petroleum Reserve-Alaska (NPRA). The National Marine Fisheries Service is responsible for certain marine species listed under the Endangered Species Act of 1973, as amended (ESA). Of these, only the bowhead whale, Balaena mysticetus, found within the waters of the Beaufort Sea off the Alaska coast, would be expected to occur in or near the NPRA.

Under Section 7 of the ESA, a Federal agency is required to consult with the Secretary of Commerce regarding the presence of these species or their designated critical habitat. If this presence is identified, the agency must then determine if the activity may affect these animals or habitats. If it finds the action would not affect these concerns, no further consultation is required. Otherwise, the action agency should notify NMFS of its findings and request consultation under the Act.

We hope this information is useful in fulfilling the requirements of the ESA. Please direct any questions you may have to Brad Smith in our Anchorage office at (907) 271-5006.

Sincerely,

James W. Balsiger for
Administrator, Alaska Region



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

January 7, 2003

Henri Bisson
State Director
Bureau of Land Management
Alaska State Office
222 W. 7th Avenue
Anchorage, Alaska 99513-7599

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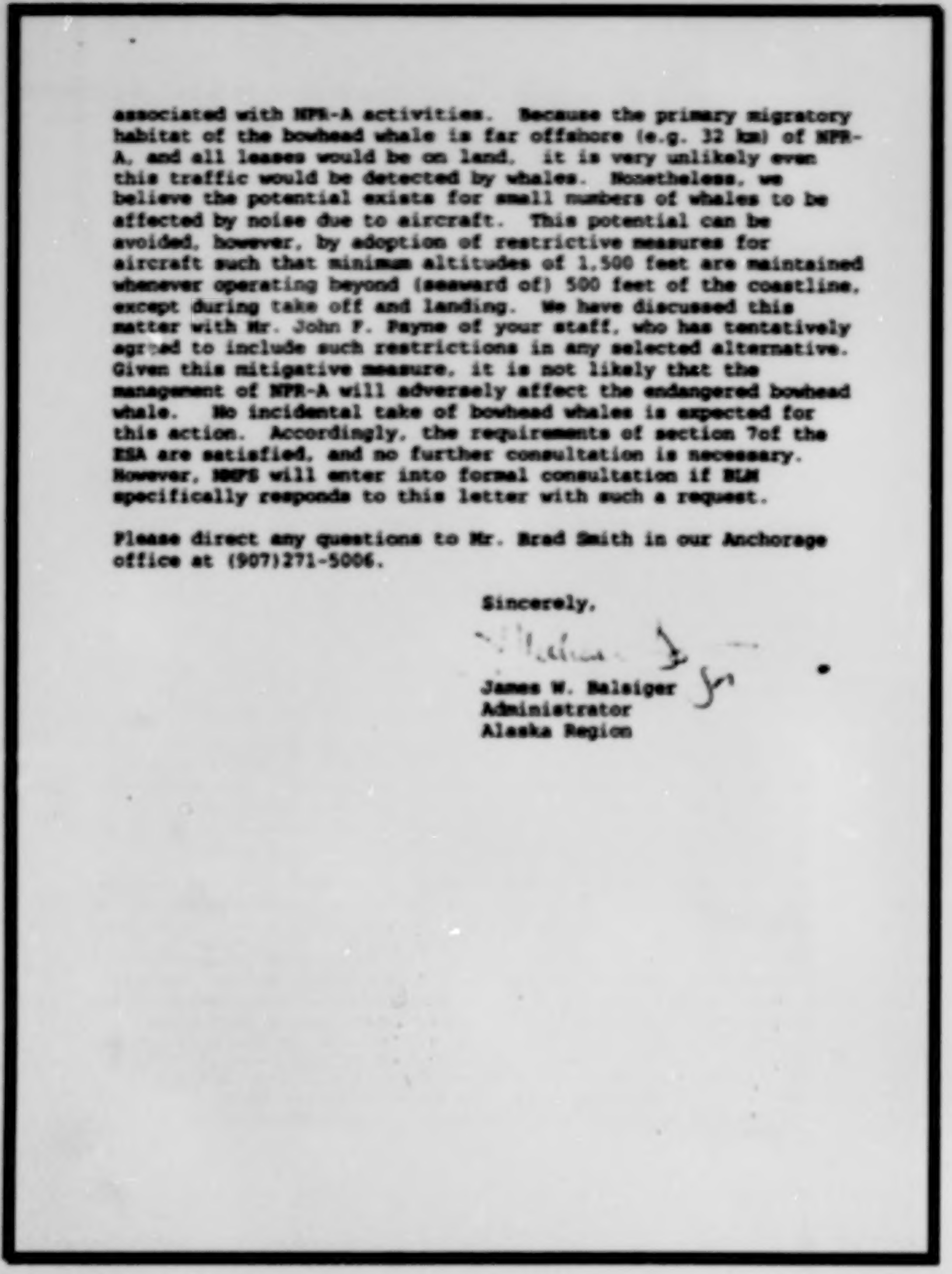
BLM

Dear Mr. Bisson:

We have received your letter of December 3, 2002 requesting formal consultation under section 7 of the Endangered Species Act, as amended, for the Federal management of the National Petroleum Reserve-Alaska (NPR-A). The Bureau of Land Management's (BLM) draft Integrated Activity Plan/Environmental Impact Statement IAP/EIS has been written to serve as the biological assessment of that action, describing the anticipated effects of the alternatives on endangered species and designated critical habitat. The endangered bowhead whale is the only such species for which the Department of Commerce/ National Marine Fisheries Service (NMFS) bears responsibility and that BLM has determined may be affected by this management strategy. No critical habitat has been designated for the bowhead whale.

The draft IAP/EIS describes four alternative strategies for the multiple-use management of 8.8 million acres of public lands in the NPR-A, along with the no-action alternative. All areas proposed for oil and gas leasing are on land. The impacts of these alternatives on the bowhead whale are assessed in the draft IAP/EIS: none of the alternatives described would present more than a negligible level of effect to bowhead whales. While oil spills are a possible adverse impact associated with oil and gas exploration and/or production, we would not reasonably expect any spill from NPR-A to enter the marine environment, nor reach areas of the Beaufort Sea used by bowhead whales. While vessels traffic is not part of the action, the impacts of noise from vessels was assessed for its impact to bowhead whales. Vessels traffic to and from NPR-A is expected to occur well inside of the primary migratory corridor of the bowhead, and to take place primarily in late July and August; after the spring migration and prior to the fall (returning) migration of these whales. While no offshore leases are associated with this action, BLM has identified a potential impact to bowhead whales due to disturbance by noise from helicopter or airplane traffic

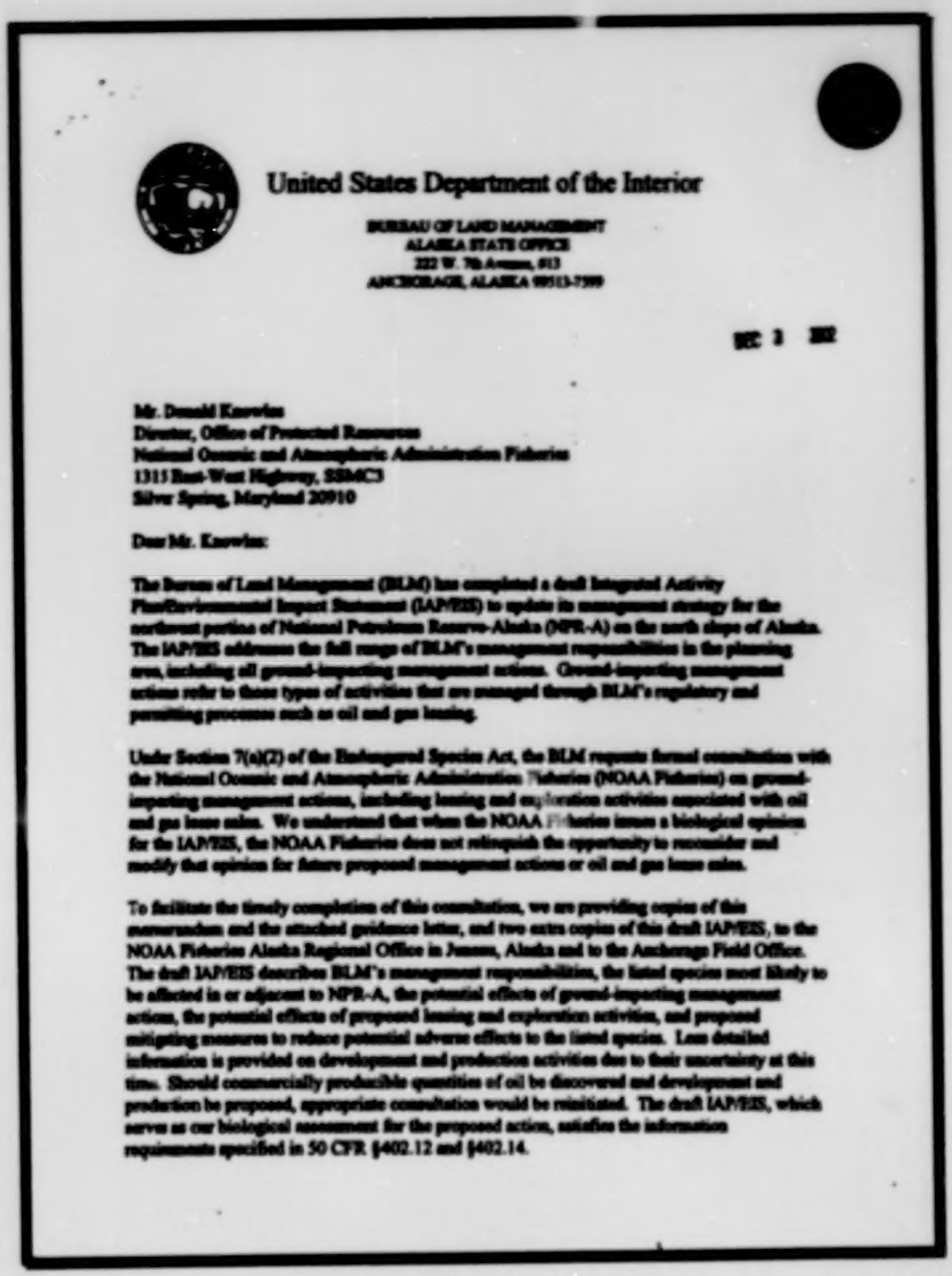


associated with NPR-A activities. Because the primary migratory habitat of the bowhead whale is far offshore (e.g. 32 km) of NPR-A, and all leases would be on land, it is very unlikely even this traffic would be detected by whales. Nonetheless, we believe the potential exists for small numbers of whales to be affected by noise due to aircraft. This potential can be avoided, however, by adoption of restrictive measures for aircraft such that minimum altitudes of 1,500 feet are maintained whenever operating beyond (seaward of) 500 feet of the coastline, except during take off and landing. We have discussed this matter with Mr. John F. Payne of your staff, who has tentatively agreed to include such restrictions in any selected alternative. Given this mitigative measure, it is not likely that the management of NPR-A will adversely affect the endangered bowhead whale. No incidental take of bowhead whales is expected for this action. Accordingly, the requirements of section 7of the ESA are satisfied, and no further consultation is necessary. However, NMFS will enter into formal consultation if BLM specifically responds to this letter with such a request.

Please direct any questions to Mr. Brad Smith in our Anchorage office at (907)271-5006.

Sincerely,

James W. Balsiger
Administrator
Alaska Region



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ALASKA STATE OFFICE
222 W. 7th Avenue, #13
ANCHORAGE, ALASKA 99513-7599

DEC 3 2002

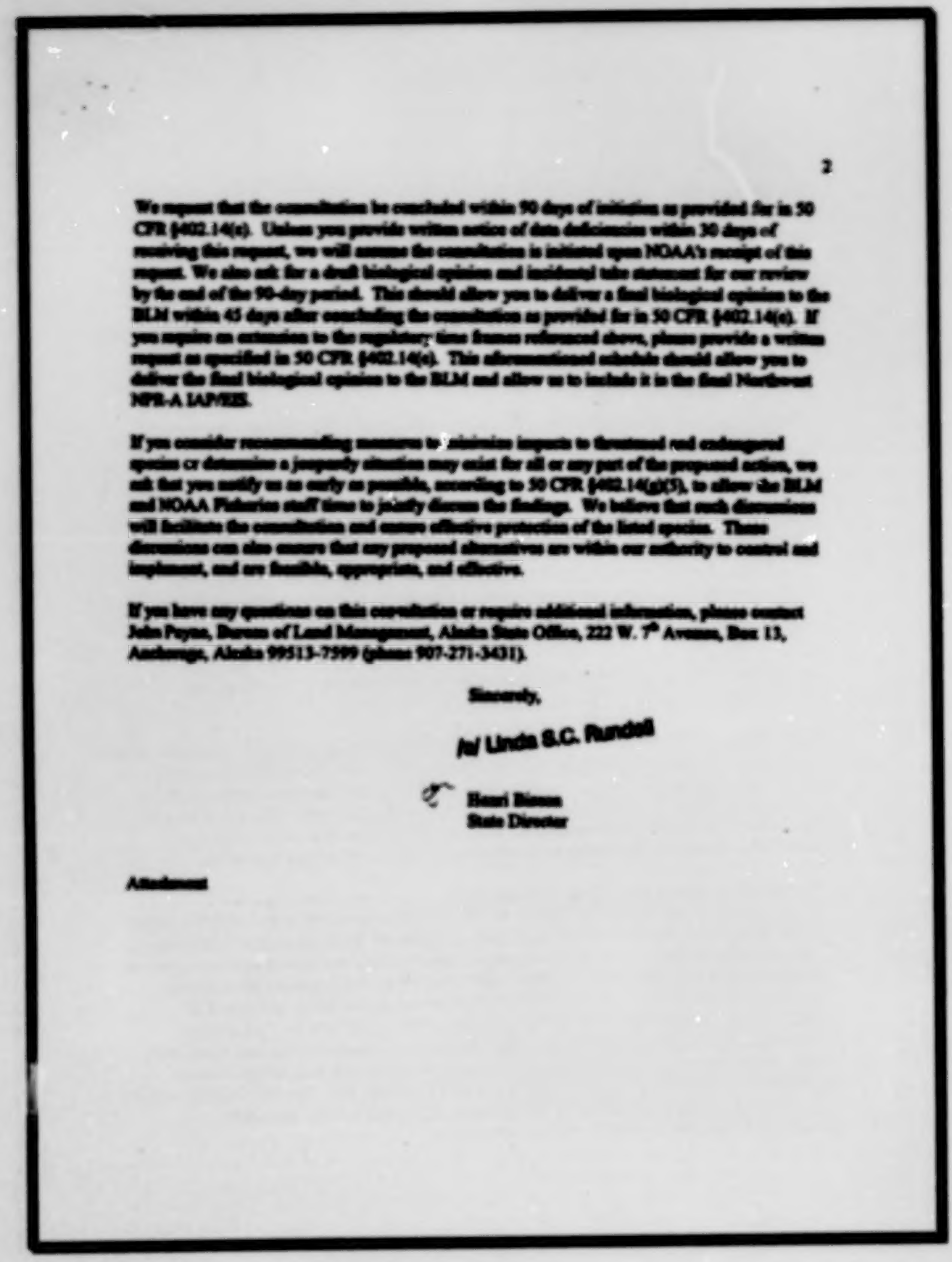
Mr. Donald Knowles
Director, Office of Protected Resources
National Oceanic and Atmospheric Administration Fisheries
1315 East-West Highway, SSMC3
Silver Spring, Maryland 20910

Dear Mr. Knowles:

The Bureau of Land Management (BLM) has completed a draft Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) to update its management strategy for the northwest portion of National Petroleum Reserve-Alaska (NPR-A) on the north slope of Alaska. The IAP/EIS addresses the full range of BLM's management responsibilities in the planning area, including all ground-impacting management actions. Ground-impacting management actions refer to those types of activities that are managed through BLM's regulatory and permitting processes such as oil and gas leasing.

Under Section 7(a)(2) of the Endangered Species Act, the BLM requests formal consultation with the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) on ground-impacting management actions, including leasing and exploration activities associated with oil and gas lease sales. We understand that when the NOAA Fisheries issues a biological opinion for the IAP/EIS, the NOAA Fisheries does not relinquish the opportunity to reconsider and modify that opinion for future proposed management actions or oil and gas lease sales.

To facilitate the timely completion of this consultation, we are providing copies of this memorandum and the attached guidance letter, and two extra copies of this draft IAP/EIS, to the NOAA Fisheries Alaska Regional Office in Juneau, Alaska and to the Anchorage Field Office. The draft IAP/EIS describes BLM's management responsibilities, the listed species most likely to be affected in or adjacent to NPR-A, the potential effects of ground-impacting management actions, the potential effects of proposed leasing and exploration activities, and proposed mitigating measures to reduce potential adverse effects to the listed species. Less detailed information is provided on development and production activities due to their uncertainty at this time. Should commercially producible quantities of oil be discovered and development and production be proposed, appropriate consultation would be reinitiated. The draft IAP/EIS, which serves as our biological assessment for the proposed action, satisfies the information requirements specified in 50 CFR §402.12 and §402.14.



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We request that the consultation be concluded within 90 days of initiation as provided for in 50 CFR §402.14(c). Unless you provide written notice of data deficiencies within 30 days of receiving this request, we will assume the consultation is initiated upon NOAA's receipt of this request. We also ask for a draft biological opinion and incidental take statement for our review by the end of the 90-day period. This should allow you to deliver a final biological opinion to the BLM within 45 days after concluding the consultation as provided for in 50 CFR §402.14(e). If you require an extension to the regulatory time frames referenced above, please provide a written request as specified in 50 CFR §402.14(e). This aforementioned schedule should allow you to deliver the final biological opinion to the BLM and allow us to include it in the final Northwest NPR-A IAP/EIS.

If you consider recommending measures to minimize impacts to threatened and endangered species or determine a jeopardy situation may exist for all or any part of the proposed action, we ask that you notify us as early as possible, according to 50 CFR §402.14(g)(5), to allow the BLM and NOAA Fisheries staff time to jointly discuss the findings. We believe that such discussions will facilitate the consultation and ensure effective protection of the listed species. These discussions can also ensure that any proposed alternatives are within our authority to control and implement, and are feasible, appropriate, and effective.

If you have any questions on this consultation or require additional information, please contact John Payne, Bureau of Land Management, Alaska State Office, 222 W. 7th Avenue, Box 13, Anchorage, Alaska 99513-7599 (phone 907-271-3431).

Sincerely,

/s/ Linda S.C. Rundell

Henri Bisson
State Director

Attachment

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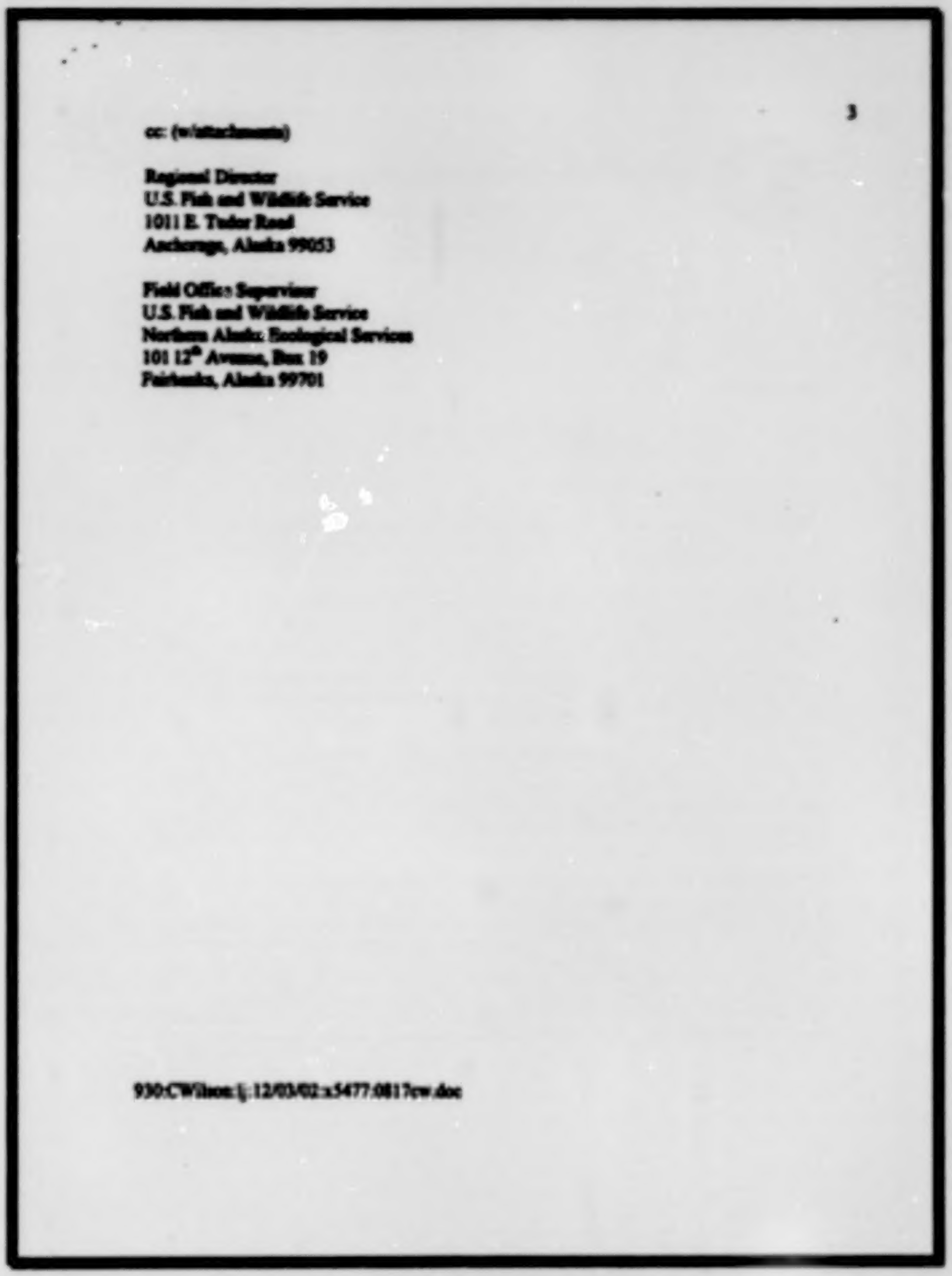

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cc: (w/attachments)

Regional Director
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, Alaska 99053

Field Office Supervisor
U.S. Fish and Wildlife Service
Northern Alaska Ecological Services
101 12th Avenue, Box 19
Fairbanks, Alaska 99701

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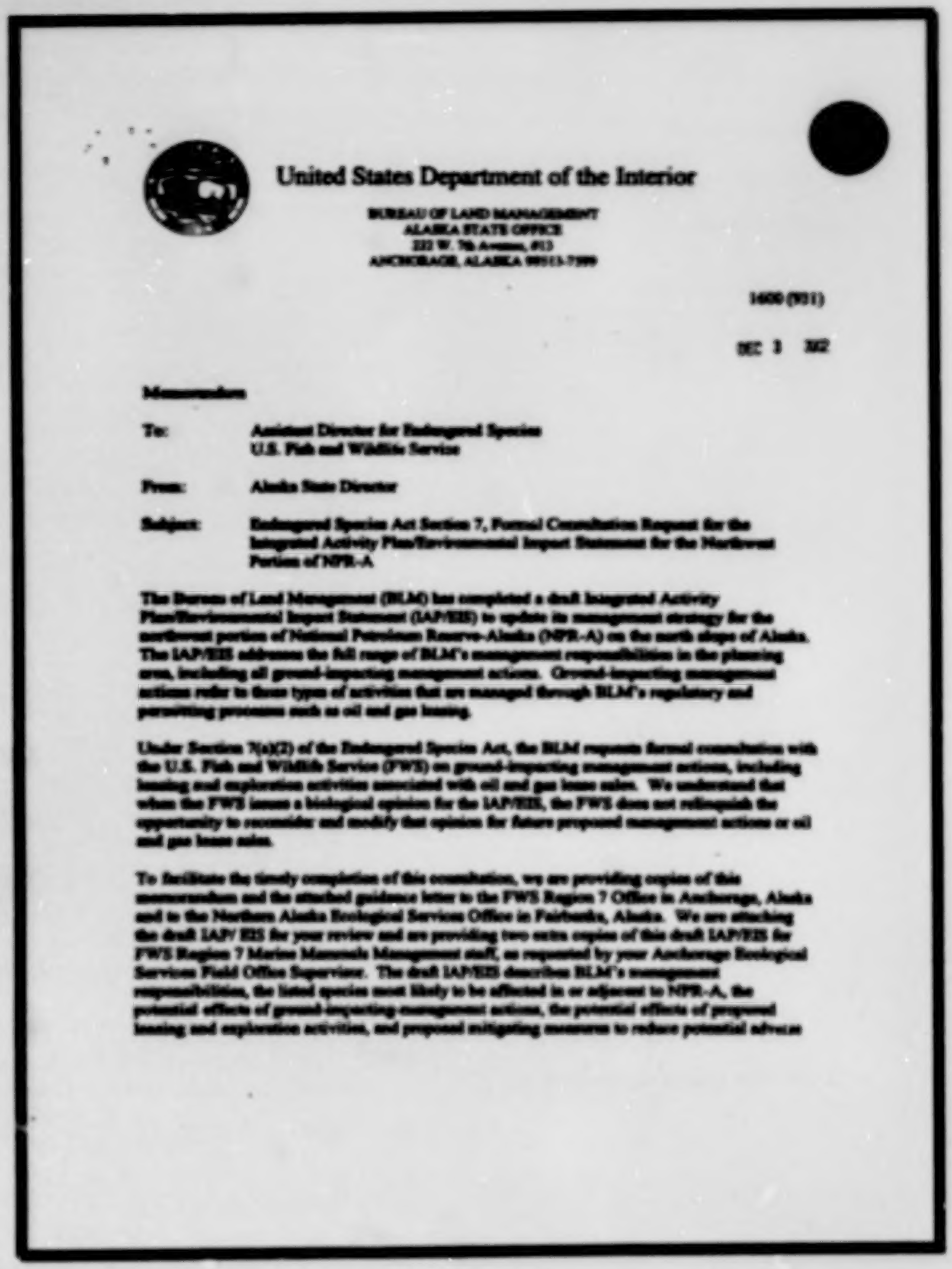


United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ALASKA STATE OFFICE
222 W. 7th Avenue, #13
ANCHORAGE, ALASKA 99513-7599

1600 (931)

DEC 3 2002

Memorandum

To: Assistant Director for Endangered Species
U.S. Fish and Wildlife Service

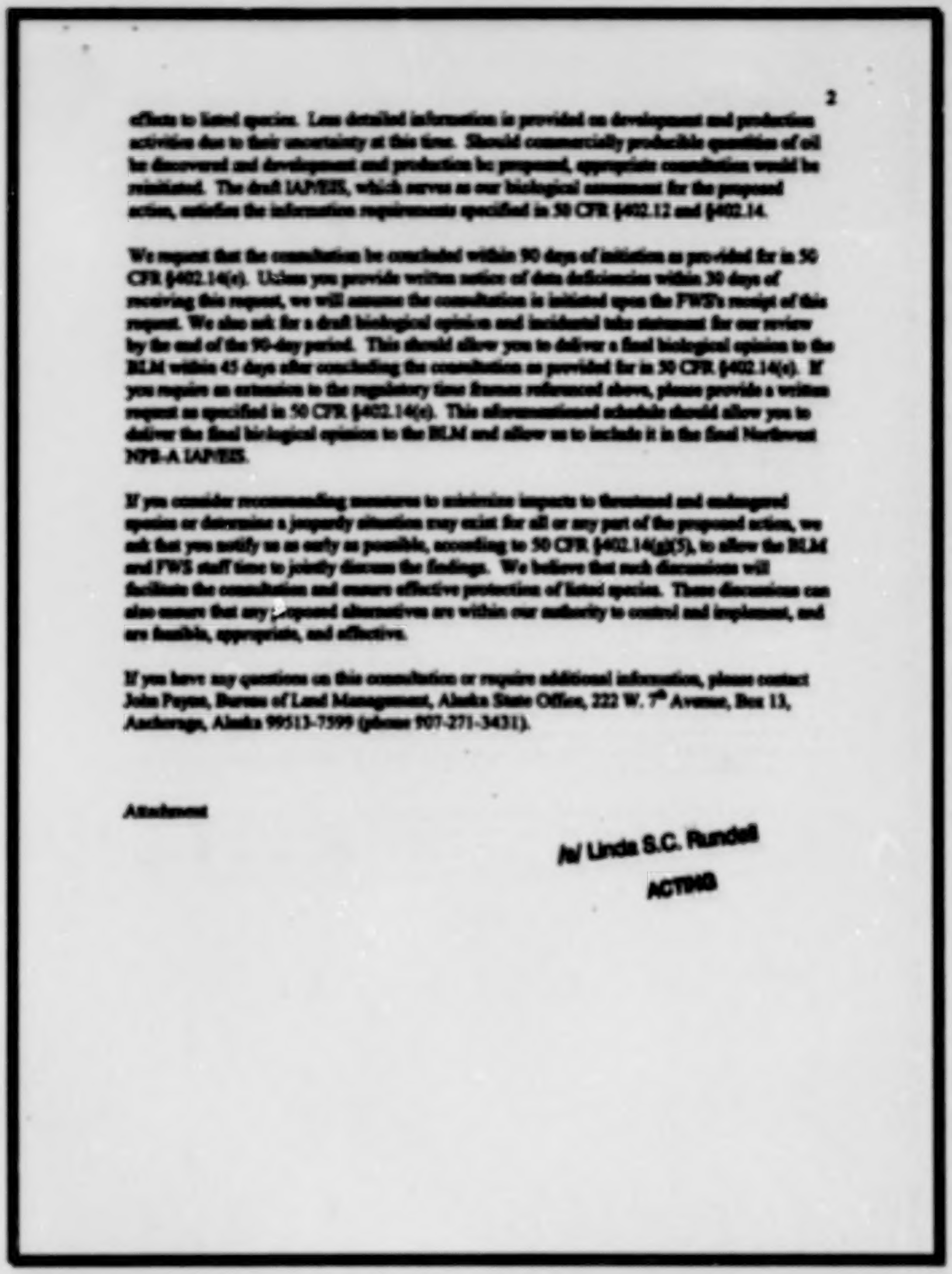
From: Alaska State Director

Subject: Endangered Species Act Section 7, Formal Consultation Request for the Integrated Activity Plan/Environmental Impact Statement for the Northwest Portion of NPR-A

The Bureau of Land Management (BLM) has completed a draft Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) to update its management strategy for the northwest portion of National Petroleum Reserve-Alaska (NPR-A) on the north slope of Alaska. The IAP/EIS addresses the full range of BLM's management responsibilities in the planning area, including all ground-impacting management actions. Ground-impacting management actions refer to those types of activities that are managed through BLM's regulatory and permitting processes such as oil and gas leasing.

Under Section 7(a)(2) of the Endangered Species Act, the BLM requests formal consultation with the U.S. Fish and Wildlife Service (FWS) on ground-impacting management actions, including leasing and exploration activities associated with oil and gas lease sales. We understand that when the FWS issues a biological opinion for the IAP/EIS, the FWS does not relinquish the opportunity to reconsider and modify that opinion for future proposed management actions or oil and gas lease sales.

To facilitate the timely completion of this consultation, we are providing copies of this memorandum and the attached guidance letter to the FWS Region 7 Office in Anchorage, Alaska and to the Northern Alaska Ecological Services Office in Fairbanks, Alaska. We are attaching the draft IAP/ EIS for your review and are providing two extra copies of this draft IAP/EIS for FWS Region 7 Marine Mammals Management staff, as requested by your Anchorage Ecological Services Field Office Supervisor. The draft IAP/EIS describes BLM's management responsibilities, the listed species most likely to be affected in or adjacent to NPR-A, the potential effects of ground-impacting management actions, the potential effects of proposed leasing and exploration activities, and proposed mitigating measures to reduce potential adverse



effects to listed species. Less detailed information is provided on development and production activities due to their uncertainty at this time. Should commercially producible quantities of oil be discovered and development and production be proposed, appropriate consultation would be reinitiated. The draft IAP/EIS, which serves as our biological assessment for the proposed action, satisfies the information requirements specified in 50 CFR §402.12 and §402.14.

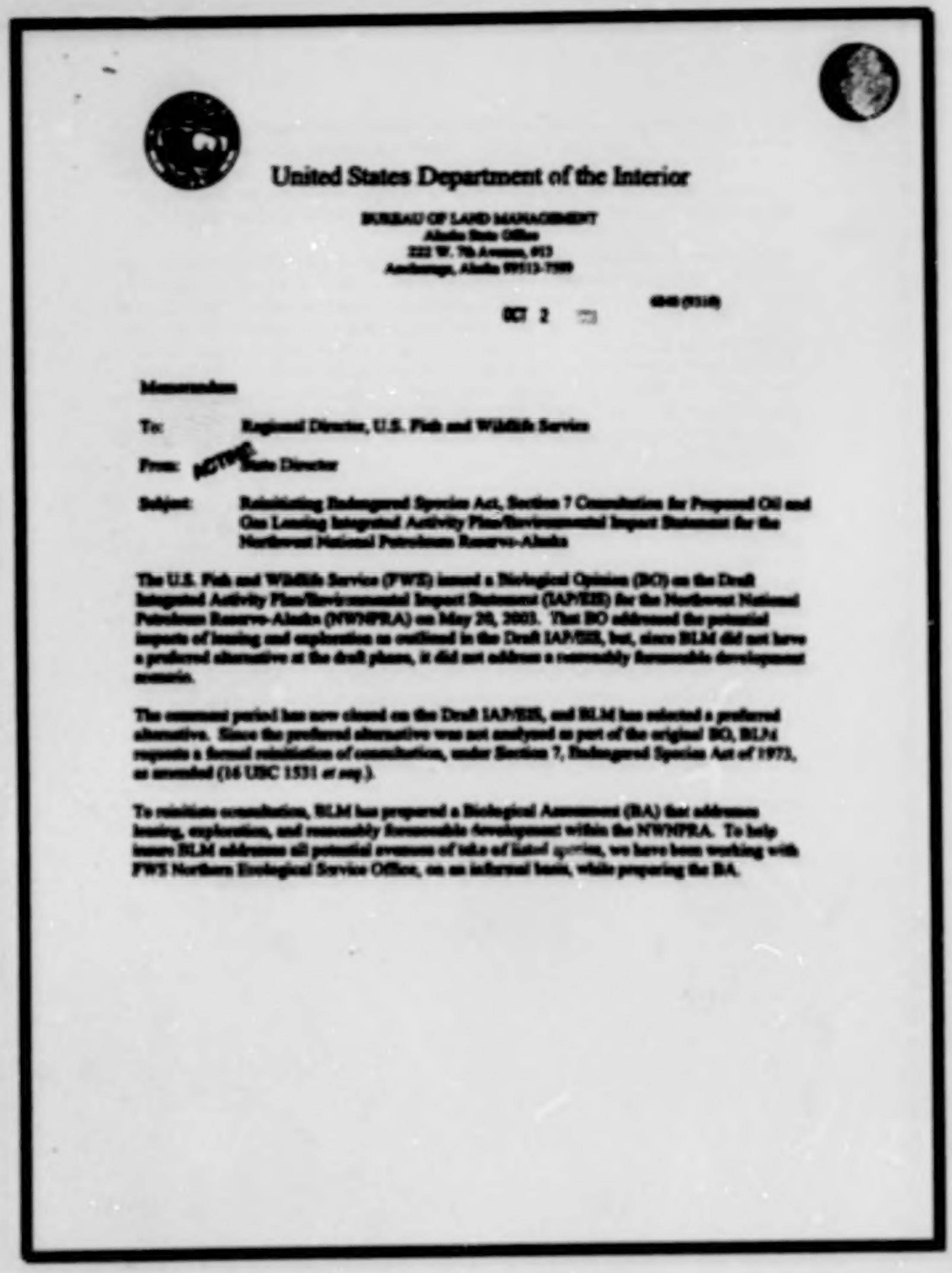
We request that the consultation be concluded within 90 days of initiation as provided for in 50 CFR §402.14(e). Unless you provide written notice of data deficiencies within 30 days of receiving this request, we will assume the consultation is initiated upon the FWS's receipt of this request. We also ask for a draft biological opinion and incidental take statement for our review by the end of the 90-day period. This should allow you to deliver a final biological opinion to the BLM within 45 days after concluding the consultation as provided for in 50 CFR §402.14(e). If you require an extension to the regulatory time frames referenced above, please provide a written request as specified in 50 CFR §402.14(e). This aforementioned schedule should allow you to deliver the final biological opinion to the BLM and allow us to include it in the final Northwest NPR-A IAP/EIS.

If you consider recommending measures to minimize impacts to threatened and endangered species or determine a jeopardy situation may exist for all or any part of the proposed action, we ask that you notify us as early as possible, according to 50 CFR §402.14(g)(5), to allow the BLM and FWS staff time to jointly discuss the findings. We believe that such discussions will facilitate the consultation and ensure effective protection of listed species. These discussions can also ensure that any proposed alternatives are within our authority to control and implement, and are feasible, appropriate, and effective.

If you have any questions on this consultation or require additional information, please contact John Payne, Bureau of Land Management, Alaska State Office, 222 W. 7th Avenue, Box 13, Anchorage, Alaska 99513-7599 (phone 907-271-3431).

Attachment

/s/ Linda S.C. Rundell
ACTING



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Alaska State Office
222 W. 7th Avenue, #13
Anchorage, Alaska 99513-7599

OCT 2 [illegible]

6840 (931)

Memorandum

To: Regional Director, U.S. Fish and Wildlife Service

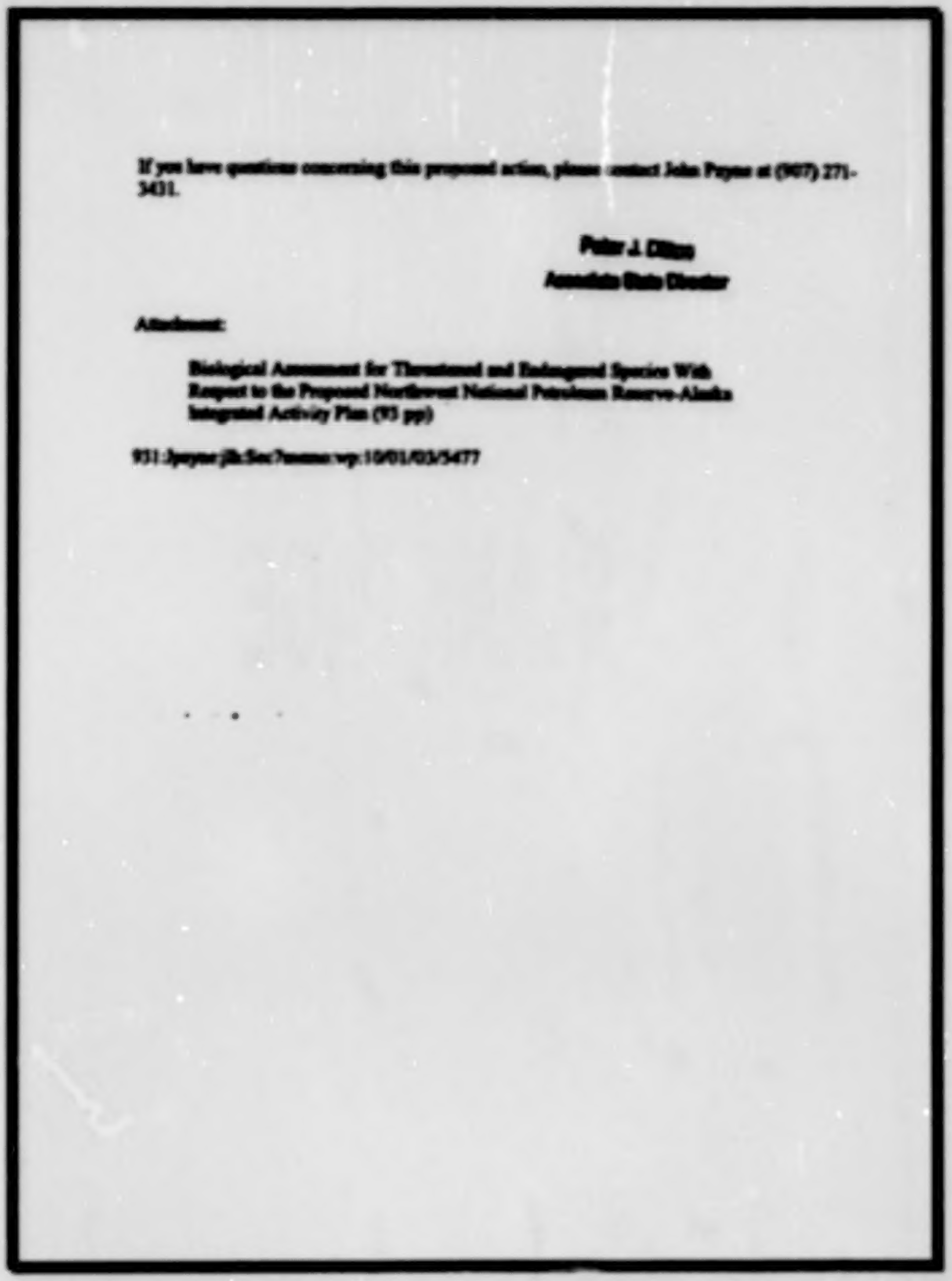
From: ACTING State Director

Subject: Reinitiating Endangered Species Act, Section 7 Consultation for Proposed Oil and Gas Leasing Integrated Activity Plan/Environmental Impact Statement for the Northwest National Petroleum Reserve-Alaska

The U.S. Fish and Wildlife Service (FWS) issued a Biological Opinion (BO) on the Draft Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the Northwest National Petroleum Reserve-Alaska (NWNPRA) on May 20, 2003. That BO addressed the potential impacts of leasing and exploration as outlined in the Draft IAP/EIS, but, since BLM did not have a preferred alternative at the draft phase, it did not address a reasonably foreseeable development scenario.

The comment period has now closed on the Draft IAP/EIS, and BLM has selected a preferred alternative. Since the preferred alternative was not analyzed as part of the original BO, BLM requests a formal reinitiation of consultation, under Section 7, Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*).

To reinitiate consultation, BLM has prepared a Biological Assessment (BA) that addresses leasing, exploration, and reasonably foreseeable development within the NWNPRA. To help insure BLM addresses all potential avenues of take of listed species, we have been working with FWS Northern Ecological Service Office, on an informal basis, while preparing the BA.



If you have questions concerning this proposed action, please contact John Payne at (907) 271-3431.

Peter J. Ditton
Associate State Director

Attachment:

Biological Assessment for Threatened and Endangered Species With Respect to the Proposed Northwest National Petroleum Reserve-Alaska Integrated Activity Plan (93 pp)

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Note to Reader: This document contains references to graphics and tables that are part of this EIS. We do not include them in this appendix because they are available to you in the Tables, Maps, and Figures sections.

Biological Assessment for Threatened and Endangered Species With Respect to the Proposed Northwest National Petroleum Reserve-Alaska Integrated Activity Plan

Prepared for Re-Initiation of Section 7 Consultation in Accordance With the Endangered Species Act of 1973, as Amended

Bureau of Land Management
Alaska State Office
October 2, 2003

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I. INTRODUCTION AND BACKGROUND

The United States Department of the Interior (USDOI), Bureau of Land Management (BLM) has initiated the process for the Northwest National Petroleum Reserve-Alaska (NPR-A) Integrated Activity Plan/Environmental Impact Statement (IAP/EIS). The management plan will fulfill BLM's responsibility for managing lands in the Northwest NPR-A Planning Area (Planning Area). The plan also fulfills mandates of the President's energy policy to undertake "environmentally responsible oil and gas development in the NPR-A." The BLM is committed to ensuring that ecosystems in the NPR-A remain healthy and productive. The management plan includes various current and future surface-impacting activities that may affect the threatened spectacled and Steller's eiders, such as aircraft use, hazardous- and solid-material removal and remediation, overland moves, seismic activities, and oil and gas leasing/exploration and development/production activities. Such activities, particularly oil and gas activities, temporary camps, and aircraft traffic associated with wildlife studies and other surveys, may result in disturbance, altered habitat, and spills of oil or other contaminants. These could adversely affect the behavior, distribution, and abundance of individual eiders or the population occurring in or adjacent to the Planning Area.

An oil and gas lease sale is scheduled tentatively for May 2004. If held, the NPR-A sale would be the seventh sale held in the NPR-A since January 1982. The first two oil and gas lease sales were held in January and May 1982, respectively. Two subsequent sales followed in 1983 and 1984, and a fifth lease sale was canceled. Sale of Northeast NPR-A leases were held in May 1999 and June 2002. Approximately 129 wells have been drilled in the NPR-A.

This biological assessment document describes the various activities under the management plan and the proposed oil and gas lease sale to the extent feasible; the distribution, abundance, and habitat use of listed eiders; the potential impacts of proposed oil and gas leasing as well as exploration, development, and production activities that might occur in the future; the potential impacts of other prescribed activities; and proposed mitigating measures that might reduce potential adverse effects on these eiders. This assessment provides sufficient information on listed eiders and potential impacts of proposed activities and activities that might occur in the future to support issuance of a biological opinion regarding the reasonable likelihood of the entire action violating Section 7(a)(2) of the Endangered Species Act, as amended. This is in response to a reinitiation of consultation on the Northwest NPR-A IAP.

The analysis incorporates conservative estimates of potential oil and gas development and production impacts on listed eiders (i.e., it attempts to estimate maximum potential impact to eiders given the entire range of potential impacts). Should commercially producible quantities of oil be discovered and development and production be proposed, consultation would be reinitiated regarding these activities. We also would consider the need for further consultation if (a) additional species were listed or critical habitat designated, (b) the proposed actions were substantially modified, or (c) significant new effects-related information was developed.

A detailed description of the endangered and threatened species within the Planning Area and effects analyses of similar proposed actions were included in the following previously issued environmental impact statements and biological opinions:

USDOI, BLM and MMS. 1998. Northeast National Petroleum Reserve-Alaska Final Integrated Activity Plan/Environmental Impact Statement. BLM/AK/PL-98/016+3130+930. Anchorage, Ak.

USDOI, BLM and MMS. In prep. Northwest National Petroleum Reserve-Alaska Final Integrated Activity Plan/Environmental Impact Statement.

USDOI, FWS. 2003. Biological Opinion for the Northwest National Petroleum Reserve-Alaska Integrated Activity Plan/Environmental Impact Statement, May 2003.

USDOI, FWS. 1998. Biological Opinion for the Northeast National Petroleum Reserve-Alaska Integrated Activity Plan/Environmental Impact Statement, March 17, 1998.

USDOI, MMS, Alaska OCS Region. 2003. Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202, Final EIS. OCS EIS/EA MMS 2003-001. Anchorage Ak.

Tables (II-01,II-03, IV-05, IV-07, IV-13, IV-19, IV-20, IV-28, IV-29, App 9-06, App 9-14); Maps (18, 62, 63, 105,108); and Figure (IV-01) were developed for the Northwest NPR-A Final IAP/EIS, and we have retained the numbering system from the EIS. They can be found after Section V in this document and in the EIS. Table II-03 of this document is the text for all of the lease-sale stipulations and required operating procedures from the EIS and is presented at the end of this document.

II. DESCRIPTION OF PROPOSED ACTIVITIES USING THE AGENCY PREFERRED ALTERNATIVE AND KEY ASSUMPTIONS IN THE ANALYSIS

II.A. Reasonable and Foreseeable Oil Development Scenario and Key Assumptions

Using the Preferred Alternative (Map 18), all BLM-administered lands within the Northwest NPR-A Planning Area would be made available for oil and gas leasing, although leasing would be deferred for 10 years on approximately 1,570,000 acres (17%) of the western portion of the Planning Area in the vicinity of Wainwright.

The reasonably foreseeable development scenario is based on a comprehensive geological analysis and computer simulation modeling completed in 2002 by the Minerals Management Service (MMS) and BLM. In this analysis, the results of petroleum resource characteristics of commercial fields, and areas where these fields are likely to be discovered and developed are modeled using an average oil price of $30 per barrel. The exact locations for future commercial projects are impossible to define prior to exploration drilling. It is uncertain any commercial fields would be discovered, particularly if oil prices fall below $20 per barrel.

II.A.1. Hydrocarbon Potential and Economics

Under the regulatory conditions of the Preferred Alternative, it is estimated that up to eight new fields would be developed as a result of multiple lease sales conducted in the Planning Area. Oil and gas fields on Alaska's North Slope typically are composed of one or more subsurface pools. These pools may or may not be grouped so that they can be produced from a common infrastructure. The first fields developed would be oil fields. Currently, no infrastructure exists to transport natural gas from the North Slope to a market. While natural gas is a byproduct of oil development, BLM does not consider natural gas production as reasonably foreseeable.

Assuming $30-per-barrel oil, 1,260 million barrels of oil could be developed in the Planning Area. Analyses of the geologic plays indicate commercial fields are most likely to be discovered in the portion of the Planning Area designated "High Potential" area (map 105) (defined as the area having the highest economic potential for oil development, based on $30-per-barrel oil). This is the coastal area surrounding Dease Inlet and west of the Ikpikpuk River.

In previous oil leases, larger fields typically have been found earlier in the exploration cycle, and are more likely to be economically viable. This reasonable and foreseeable scenario assumes the first fields developed in the Planning Area would approximate the size of the Alpine field (Figure IV.01) in extent of gravel cover, petroleum resources, associated activity, and current technology. The following hypothetical discovery and related reasonably foreseeable development, and production schedule, is BLM's estimate of the types and timing of activities that may occur as a result of multiple lease sales under the Preferred Alternative.

Analysis is based on two distinct, but related phases, in the discovery and development of an oil field on the North Slope of Alaska. In the first phase a lease sale is held, followed by the successful lessee entering into an exploration program. The second phase is success in discovery, followed by the construction of production facilities, operation and, in approximately 30 years, abandonment of the sites.

II.A.2. Key Assumptions for Analysis

Key assumptions for this biological assessment ensure the analysis is conservative with respect to the listed species. The following reasonably foreseeable scenario assumes all of the projected development would occur in the area of high potential for oil and gas development (Map 105).

The densities of listed eiders within the Planning Area are assumed equal to the highest densities of listed eiders observed within the area of highest geologic potential (Map 105). The spectacled eider density figure used for this analysis was derived from a multiyear aerial survey data set (1992-2002) collected by the Fish and Wildlife Service (FWS). This survey was designed and timed specifically for eider detection across the Arctic Coastal Plain (ACP). The area of high geologic potential includes areas of high spectacled eider density; thus, BLM chose the high end of the range of spectacled eider densities (1.11 birds/km^2) as the basis for analysis.

The density figure for Steller's eiders was derived from a multiyear aerial survey data set (1999-2002) designed specifically for detecting Steller's eiders in the "Barrow Triangle," a 2,757- square kilometer area south of Barrow and west of Admiralty Bay, which overlaps with the area of highest geologic potential (Map 105). Density values are available only for the survey area as a whole and vary considerably among years. The BLM chose to use the density recorded in 1999 (0.06 birds/km^2), which was the highest density recorded in the 4 years of the survey. This is considered to be a midlevel density, lower than that recorded on foot surveys in the immediate vicinity of Barrow, but higher than the overall average density across the ACP, as determined by FWS aerial eider surveys. This midlevel density figure was selected, because no high-density Steller's eider areas have been found in the area of high economic potential.

The selected densities are intended to represent the high end of a reasonable range, in recognition of the uncertainties regarding the future location of facilities, as well as imprecise information on eider distribution. Use of these density figures would likely result in the overestimation of potential impacts to listed eiders, thus ensuring that if development occurs elsewhere in the Planning Area, the effects generally would be equal to or less than those noted in this assessment. The assumed densities, however, do not compensate for the bias inherent in estimating bird densities from the air. An established/accepted visibility correction factor is not currently available to apply to eiders detected on the aerial surveys. A visibility correction factor allows the numbers of individuals observed from the air to be converted to a more accurate representation of the actual number of birds present, compensating for those birds that are not detected from the aircraft. In the absence of such a correction factor, BLM assumes the aerial survey data used for this biological assessment may underestimate both population and densities of listed eiders within the Planning Area. However, using the highest densities and providing an analysis using the $30-per-barrel cost, zone of influence, assuming the six satellite fields will have their own separate 20-mile connection road to the anchor facility and not considering Required Operating Procedure E-11 (Table II-03), BLM likely would overestimate the potential effect on both species of eider.

To address disturbance effects to eiders, in addition to the immediate habitat loss from gravel pad and road development, BLM is assuming both a 200- and a 500-meter zone of influence around all gravel pads and roads. The 200-meter zone of influence has been used in previous analysis by FWS but is based on best professional judgment, and little empirical data supports its use. The BLM also has chosen to provide a

500-meter zone of influence to allow for a determination of the maximum number of eiders that potentially could be affected by production facilities.

The Preferred Alternative provides an opportunity to lease in the immediate offshore area of the Planning Area, which includes Dease Inlet and Admiralty Bay. These shorelines are protected by a ¾ mile no surface occupancy (NSO) requirement (Map 18), both offshore and onshore, to protect the nearshore habitats. While reasonable and foreseeable projections do not anticipate production facilities offshore, these areas likely would be included in the exploration phase. The offshore areas would be reached using directional drilling techniques either anchored onshore or from bottom-founded offshore ice islands. All exploration activities would occur in winter and use ice roads to move equipment and materials from the staging areas to the exploration sites.

Development assumes 36 exploration wells and 36 delineation wells using three exploration drill rigs. Previous experience, in an unproven, high-cost, frontier area, has shown 36 exploration wells typically are required to discover an estimated eight economically developable fields (at $30 per barrel oil). Delineation and appraisal exploration would require three winter seasons to determine the extent of each field. While exploration activities primarily would be a winter exercise, "cold stacking," or the storage of exploration equipment, would occur at designated sites that are accessible by helicopter or fixed-wing aircraft during the summer season to allow for occasional routine inspection.

For analysis it is assumed development would include two "anchor" developments (Alpine-like[1] in design, Figure IV.01), each with three connected satellite facilities connected to each anchor, for a total of eight fields. Anchor developments are "stand-alone" facilities with processing equipment for separating oil and gas, waste handling, and transport of oil through pipelines to large-scale distribution systems. Satellite developments involve fields too small to support full-scale operations and must rely on anchor facilities to separate the oil and gas, waste handling and the transport of oil to large-scale distribution systems. Each Alpine-like anchor development would consist of both a production and a processing facility. Current technology and economic considerations limit satellite fields to a maximum of 20 miles from an anchor facility. Current technology allows for "roadless" facilities, which means roads would exist within and between the satellite and anchor developments, but no roads would connect the two anchor developments to each other. No "feeder" roads would be constructed connecting existing infrastructure in the Alpine area to either of the anchor developments. Geologic information, economics of extraction, and proximity to existing infrastructure in the Colville River Delta suggest this reasonably foreseeable development would take place within the area of high economic oil and gas potential. Within the Planning Area, the highest potential for success is in the northeast portion of the area (Map 105). None of these facilities would require the establishment of new landfill locations. The approved landfill currently in operation at Deadhorse most likely would be used for materials not requiring additional treatment. Organic wastes would be disposed of in accordance with the Clean Water and Clean Air Acts, and the disposal of any liquid or solid waste would not be permitted on site (Required Operating Procedure A-2, Table II-03).

Assuming the first lease sale occurs in 2004, the first exploration activities would occur in the winter of 2004, and the first discovery in 2006.

II.B. Phase I: Leasing and Exploration

The Preferred Alternative indicates the first lease sale in early in 2004, with leases issued later that year. Exploration actions would begin the following winter season.

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[1] The Alpine development, owned and operated by Conoco/Phillips-Alaska, incorporates the most recent design and operational technology on the North Slope of Alaska. The footprint of this development is the most likely development type in the Northwest NPR-A.

II.B.1. Seismic Activities for Exploration

Seismic surveying occurs during the winter months and is expected to begin during the winter season of 2004-2005. Typically, three to four seismic crews are active on the North Slope each winter, and one to two of those crews could be expected to collect seismic data in the Planning Area in future years. Seismic crews are housed in mobile camps consisting of a "cat train" of trailer sleds pulled by tractors. Winter seismic operations are conducted by all-terrain ground vehicles and supported by light aircraft. Current seismic technology uses vibrator equipment (vibroseis) to generate energy into the subsurface. A limited amount of support by aircraft (fixed wing and helicopter) would be needed to survey potential sites during summer months to prepare for intensive activities.

The only activities associated with seismic that would occur during the summer would be annual maintenance. Following the end of each winter seismic season, each seismic crew stores its equipment at some staging area, which is usually an existing gravel pad built previously for some other purpose (during exploration in the Northeast NPR-A, seismic equipement was stored in the summer of 2003 at Lonely and Inigok, both previous development areas). Sometime during the summer, a repair crew would spend 2-4 weeks performing annual maintenance and installing upgrades to the seismic equipment. These activities would require aircraft support, with one to two fixed-wing and two to three helicopter flights per week. On completion of the maintenance work, the crew would leave the equipment cold stacked and there would be no activity until the following winter. For analysis purposes, we assume the maintenance operation would be self contained and use accommodations that are part of the seismic camp. Also on completion of the work, all wastes would be removed and disposed of at approved disposal sites on the North Slope. None of these activities would require the establishment of new landfill locations. The approved landfill currently in operation at Deadhorse most likely would be used for materials not requiring additional treatment. Organic wastes would be disposed of in accordance with the Clean Water and Clean Air Acts, and the disposal of any liquid or solid waste would not be permitted on site (Required Operating Procedure A-2, Table II-03).

II.B.2. Exploration Drilling

There would be a maximum of three exploration drill rigs available for use in the Planning Area at any one time, over a 10-year maximum exploration phase.

Drilling depths for exploration and delineation wells average 10,000 feet but are likely to range from 6,000-12,000 feet. Drilling would be conducted entirely during the winter months (early December to mid-April). A typical exploratory well (10,000 feet) could use about 630 short tons of drilling mud and produce about 820 short tons of dry-rock cuttings. On completion of drilling operations, all equipment and materials would be removed (during winter operations) over ice roads to staging areas and then to other locations on the North Slope, or to recycling centers out of the country. Drilling material (mud and cuttings) could be reinjected into the dry drill hole if the exploration well is unsuccessful. If drilling is successful, the well would be temporarily capped, and the operator would remove drilling materials (mud and cuttings) and other camp wastes to an approved disposal area off site in accordance with the Clean Water and Clean Air Acts. No liquid or solid waste would be disposed of on site.

The Preferred Alternative provides an opportunity to lease in the immediate offshore area of the Planning Area, which includes Dease Inlet and Admiralty Bay. All activities would occur in winter, and use ice roads to move equipment and materials from the staging areas to the exploration sites.

II.B.3 Winter Transportation and Support Infrastructure for Exploration

Ice roads would provide seasonal routes supporting winter activities. These temporary roads are constructed by spreading water from local sources (rivers and lakes) to build up a rigid base (Stipulation B-1). New construction methods, such as the use of aggregate chips produced from frozen lakes, significantly decrease both water demands and construction time for ice roads. Low-pressure vehicles are used to establish ice roads, which can then be used by conventional vehicles. Ice roads are designed to be a minimum of 6 inches thick, 30-35 feet wide, and up to 50 miles long. Ice roads would connect each exploration drill site to the staging area during winter activities.

Ice pads are used commonly as platforms for winter exploration activities (e.g., Northeast NPR-A exploration, 1999-2003). Methodology used in ice pad construction is similar to ice roads. The tundra surface is flooded with water to build up progressive layers of ice. Just as for ice roads, the use of aggregate chips speeds the process while decreasing water use. A typical ice pad is designed to be a minimum of 1 foot thick, covers 6 acres, and requires approximately 500,000 gallons of water to construct. Depending on the exploratory well location, ice pads range in size from 3-10 acres. Current ice-pad design technology could provide for some pads to remain intact over the summer season. During the summer season, these ice pads would house one exploration drill rig. Each of these rigs would be stored with towers or derricks folded and would present a silhouette of approximately 20 feet in height. The impact of this activity could result in a temporary loss of eider habitat equivalent to the ice-pad size (3-10 acres).

Materials and equipment necessary to support winter exploration activities could be moved to staging areas within the Planning Area by marine transport in the summer months (late July/August), and then overland on ice roads or hardened snow trails during winter exploration activities. The sealifts for exploration would use two to seven barges per year. The majority of large equipment movement would be by sealift to staging areas at Cape Simpson, Deadhorse, or Barrow or during summer months, then to the exploration pads over ice roads during winter months. These exploration staging areas would be small (500 feet by 500 feet and gravel or sand-gravel pads), with summer activity limited to offloading and storage. When possible, existing pads would be used. These activities would occur annually during the exploration phase, which may last up to 9 years after the sale.

While this scenario assumes that Barrow could be used as a staging area for the western portion of the Planning Area, BLM does not anticipate development projects for direct support of exploration activities at or near that community. Barrow already is a regional hub for commerce on the western North Slope, with an established airport and support facilities that can accommodate most large planes currently used to support the oil and gas industry in Alaska. Infrastructure currently exists in Barrow to handle sealifts during summer months and air freight during winter months that routinely stock the community.

There would be some additional employment and investment in the community during the exploration and construction phases, but the level of additional employment would be small and short term. The majority of support for exploration is expected to be deployed from Deadhorse because of its proximity to the Dalton Highway (Haul Road) and existing oil field contractor-support facilities and infrastructure.

II.C. Phase II: Development, Production, and Abandonment

If exploration activities are successful and an economically viable field is discovered, companies likely would move forward to development and production. The first part of these processes is the gathering of information and data, designing, and permitting of the project. All development projects would have to go through a National Environmental Policy Act evaluation and would require consultation with the FWS pertaining to the listed eiders. If ice roads or pads are needed during the production and abandonment phase, these activities would be essentially the same as those described in II.B.2.

II.C.1. Drill-Pad and Road Construction

Construction of gravel pads, roads, airstrips, and staging areas would be some of the first development activities to take place.

Current technology uses gravel pads to support both anchor and satellite production facilities. Gravel requirements for current "all-gravel" pads raised 5 feet or more above a wet tundra surface are approximately 8,000-12,000 cubic yards per acre of surface footprint. Gravel roads (35 feet wide with 2:1 slopes) cover approximately 5-6 acres per mile, and require 30,000-50,000 cubic yards of gravel per mile. Airstrips (150-200 feet wide, and 5,000-6,000 feet long) cover 20-30 acres and require 140,000-300,000 cubic yards of gravel. Total gravel estimates for an Alpine-like field, with a footprint of 100 acres, is approximately 1,000,000 cubic yards. Any staging area or pump station sites would have similar gravel requirements. A staging area (150 acres) and pump station (40 acres) would require an additional 1,400,000 cubic yards of gravel.

Gravel mining and transportation would occur during winter months when gravel can be moved by heavy equipement over ice roads. Where gravel extraction has occurred on the North Slope, sites are 20-50 acres in size. Two anchor development sites and six satellite pads with roads would require the development of up to eight extraction sites. The location of those potential mine sites is unknown at this time. If larger sites are discovered, extraction footprint per site could exceed 50 acres in size but the number of sites would be reduced, and the total disturbance footprint also would be less (280 acres). Gravel extraction sites necessarily would be located within the area of highest geological potential because of the high cost of material transport.

II.C.2. Field Development

It is assumed that two Alpine-size fields, or anchor developments, would be discovered in the Planning Area, with six additional satellite fields tied into the infrastructure of the anchor fields. Each anchor facility would produce an estimated 450 million barrels of oil, with each satellite facility producing an estimated 60 million barrels. A reasonable and foreseeable scenario suggests each satellite field would be connected to an anchor development (Alpine-size) field. Current pipeline engineering constraints dictate satellite fields be located within 20 miles of an anchor field. Discovered fields that do not have enough oil to be economically developed, or are too far away from an anchor development using today's technology, would not be developed and would have no pads. None of these facilities would require a new landfill location. Organic wastes would be disposed of in accordance with the Clean Water and Clean Air Acts. No liquid or solid waste would be disposed of on site.

Each anchor development would consist of gravel pads covering a total of 100 acres (including an airstrip of 5,000 feet, secondary drill pad, and connecting road). Runways would be oriented in a west-southwest/east-northeast direction similar to the Barrow Airport. Each anchor development would have a secondary drill pad located within a 3-mile radius of the main pad. The secondary pad would be connected to the anchor facility by a 3-mile long gravel road. No overnight accommodations would be available at the secondary pad.

A typical satellite field would be developed from a single gravel pad with a footprint of approximately 10 acres. Each pad would hold approximately 20-30 wells and would be accessed from the anchor development on a permanent gravel road 30-35 feet wide, with a 2:1 aspect, and up to 20 miles in length. Three satellite fields would be developed for each anchor facility. However, satellite field development would not be expected for several years after the anchor facility is developed (this is true of the Alpine development), and would have a production life of approximately 10 years.

The total area of gravel footprint for all above potential developments, as well as for two scenarios for summertime "zones of influence" (i.e., zones of potential disturbance to eiders) around the gravel pads is presented below in Table 1.

Table I. Gravel Footprint and Zones of Influence for Production and Related Facilities

Activity	Gravel Footprint in Acres (km^2)	200-Meter Zone of Influence in Acres (km^2)	500-Meter Zone of Influence in Acres (km^2)
Anchor Developments (2 at 100 acres each)	200 (0.8)	1,590 (6.4)	3,980 (16.1)
Satellite Developments (6 at 100 acres each)	600 (2.4)	19,100 (77.2)	47,700 (193)
Roadless Pump Station	40 (0.2)	240 (1.0)	600 (2.4)
Gravel Extraction Sites (8 at 20-50 acres each)	280 (1.1)	n/a	n/a
Staging Area (2)	300 (1.2)	680 (2.8)	1,680 (6.8)
Total Area	1,420(5.7)	21,610 (87.4)	53,960 (218.3)

The time required to drill, and complete, a production well depends largely on the measured depth of the well. Currently on the North Slope, it takes approximately 20-30 days to drill and complete a 10,000-foot well. This equates to approximately 12-18 wells per rig in an over a 12-month period. There would be a maximum of eight development rigs operating at any given time over a period of 6 years (Table IV-02). Safety considerations normally restrict operations to one rig drilling on each pad at a time. Using the above example where up to 30 wells from each pad are needed for initial reservoir development, drilling operations would take 3-4 years to complete. The overall developement phase from construction of a staging area and remote base camp to production startup could take up to 5 years, depending on the size and location of the new field.

The description of exploration activities in Section II.B.3 (Winter Transportation and Support Infrastructure for Exploration) for staging areas and sealifts also is applicable during the development phase, with respect to time and types of activities. During development, the staging area(s) may be larger, up to 150 acres. Development of the staging area would occur in winter prior to the start of development activities. The number of barges required in each sealift to support development activities would be larger (up to 20 barges/year). However, the modules and equipment still would be offloaded from barges in 3-5 days and stored on the staging area pad until winter, when they would be transported by ice road to the anchor development site. The individual modules could be 20-30 feet in height. After transportation to the anchor development sites, these modules would become the site's operation and housing facilities complex. There likely would be two large sealifts (1 year apart) for each anchor development.

II.C.2.a Development of Production Pad and Facility

The first production pad (anchor pad) would be installed in 2012 (8 years after the lease sale). Up to 150 production and injection wells would be drilled year-round from three drilling pads over a period of 6 years. A maximum of eight drill rigs would be used to drill wells.

II.C.2.b. Central Production Facility

The central production facility (or CPF) serves as the operational center for long-term production activities in an oil field. In addition to oil-production equipment, the CPF typically includes living quarters, offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, and a communications center. For most North Slope projects, many components of the CPF are constructed as transportable modules in offsite locations, normally outside Alaska, and then moved to staging areas in the summer by sealift. The following winter they are moved overland on ice roads to the field and assembled. All buildings are supported on pilings to accommodate ground settling or frost heaving. An airstrip usually is located near the CPF to allow transport of supplies and personnel to the field site.

Power, telephone, and other communication lines would be buried in the roads or installed on the pipeline vertical support members (VSM's). Each anchor facility would have one tall (up to 60 feet) communication tower. ROP E-11 provides for mitigation to mark the tower guy wires, increasing visibility to reduce potential collision by listed eiders. Communication towers would be co-located on facility pads.

Oil production equipment includes three-phase separators (oil, gas, and water are produced in varying proportions from each well); gas conditioning (natural gas liquids are striped from produced gas); complex pipeline gathering and pressure regulation systems; and well monitoring and control systems. Oil from production wells is filtered (to remove sand) and processed (removing water and gas) before being piped through a sales meter and into the sales-oil pipeline system. Gas is processed (to remove liquids), pressurized (compressed), and reinjected into the reservoir through service wells. Likewise, water is processed (chemically treated) and then reinjected into the reservoir for pressure maintenance. Reinjection of produced gas and water increases oil recovery, and this practice is normally initiated from the onset of production.

II.C.2.c. Pipeline Infrastructure

The actual locations of new pipelines constructed in the Planning Area depend on both the location and sequence of discoveries of commercial-sized oil fields. Fields developed early would establish the first pipeline corridors connecting the Planning Area production to existing infrastructure at Alpine. Fields discovered and developed later would attempt to use these existing pipelines, if capacity is available. If large fields are discovered late in the exploration sequence, they may require their own oil pipelines. It is possible that commercial-sized fields discovered by different companies would be shut in (not produced) until an agreement is reached to share the costs of constructing a large main line from the Planning Area to common carrier pipelines that connect to the Trans-Alaska Pipeline System. In this analysis, one connecting pipeline would be constructed to the existing Alpine facility, which has infrastructure available to connect to the Trans-Alaska Pipeline System.

The scenario developed for the Preferred Alternative assumes that 240 miles of pipeline would be installed during the winter, coinciding with the construction of the development and production facilities. It would consist of approximately 115 miles of elevated field gathering lines for oil and 125 miles of elevated oil trunk lines. The gathering pipeline would consist of a connecting multiphase pipelines (a 24-inch oil pipeline, a 14-inch water pipeline, and a 10-inch gas pipeline) installed aboveground on VSM's, and would be an average of 7 feet above the tundra. The VSM's would be spaced 50-70 feet apart. Routine pipeline maintenance would occur during winter months, with summer activities on an emergency basis only.

Possible future pipeline corridors in the Planning Area are speculative, but routes would be based on several factors including oil-resource potential, previous leasing, and previous discoveries. The actual location of undiscovered, commercial-size fields and the timing of discovery, are impossible to predict. For analysis purposes, 225 miles of common carrier trunk line would be constructed in the Northeast NPR-A area, with an additional 120 miles constructed on State lands to the east to transport product to market (Map 108).

None of the above pipelines would be established as subsea infrastructure.

II.C.2.d. Aircraft Support during Development

The highest level of human activity would occur during the period when both construction and development drilling are occurring. From June 1, 2001, to July 15, 2002, there were a total of 1,474 aircraft landings or take offs (a daily average of 32.8 operations) at the Alpine site (Johnson, et al, 2003; ABR, Inc., 2001). About half of the aircraft operations were helicopter flights. The next largest group is primarily passenger planes (CASA, Twin Otter, Navajo, Beech), averaging seven flights per day. On average, there was one DC-6 round trip flight per day. We expect similar levels of aircraft activity during the summer development phases for each of the anchor developments.

II.C.2.e. Offshore Development Related to the Planning Area

The Preferred Alternative provides an opportunity to lease in the immediate offshore area of the Planning Area, including Dease Inlet, Admiralty Bay and Elson Lagoon. The shorelines are protected by a ¾ mile NSO (Map 18) requirement, both offshore and onshore, to protect the nearshore habitats. Reasonably foreseeable projections do not anticipate production facilities offshore. If a commercially viable discovery is made in the offshore area, it most likely would be reached using directional drilling techniques anchored onshore, and a new analysis would be prepared to address the specific issues related to offshore production. If development occurred offshore, it likely would be constructed using materials and techniques similar to those used at island bearing the Northstar development (U.S. Army Corps of Engineers, 1999).

Most of the construction activities for the island and for the buried subsea pipeline would occur during the winter months. Barges would be used to bring equipment and facilities to the island as part of the annual summer sealift operations. Helicopters would be used to transport people and equipment year around. Boats could be used during summer months, and an ice road would be built each winter to facilitate the movement of people and equipment from staging areas to island facility. The number of helicopter trips would depend on the location of the island and its proximity to other staging areas.

II.D. Production

The field infrastructure would include processing facilities and a permanent airstrip and would operate year-round for at least 20 years. The first production would start up in 2013 (9 years after the lease sale), and peak rates would be 38 million barrels per year (104,000 barrels per day).

II.D.1. Production Activities

During production, the size of the gravel footprint would remain constant. There would be higher levels of human activities at the two anchor development sites than at the satellite, or secondary pads. The number of aircraft flights to support the facility is estimated at four propeller-driven passenger planes (CASA, Twin Otter, Navajo, Beech) and 5-10 helicopter flights per week. There would some truck traffic from the main facilities to satellite and secondary pads on a daily basis. There would be helicopter flights along the length of the pipeline to monitor its integrity on a monthly basis at a minimum.

The pipelines would be pigged and electronically monitored to determine pipeline integrity. Pipeline maintenance would be planned and occur during the winter months when the pipeline could be readily accessed by ice road or hardened snow trail.

Wastes generated at the production facility would be incinerated at the facility or treated and transported to approved disposal sites on the North Slope.

II.D.2. Watercraft Support to Production Facilities

It is likely that facilities would be supplied by annual sealift. Most of these supplies would arrive in containers by barge in late July or August. The container would be offloaded with cranes and stacked on the gravel pad at the staging area. The typical container is less than 10 feet in height. This vessel traffic generally would be limited to routes in shallow, nearshore waters between staging areas connected to existing infrastructure (e.g., West Dock, or Oliktok Point) and staging areas along the coastline in the Planning Area at Cape Simpson or Barrow.

Nonrecreational airboat use is allowed on streams, lakes, and estuaries seasonally accessible by motorboats. Airboats would be prohibited in seasonally flooded tundra and shallow waters with wetland vegetation adjacent to streams, lakes, and estuaries (Table II-01). For this analysis, it is assumed no facilities would be constructed adjacent to waterways that could support nonrecreational use of watercraft because of setbacks required by stipulations K-1, 2 and 3.

II.D.3. Public Access and Subsistence Activities

The developments described would not be accessible to the general public for recreational or tourism activities. However, the areas would be available to rural subsistence users. Subsistence use of the Planning Area is variable due to the availability and location of species available for subsistence harvest. It is possible that an unknown number of subsistence activities could be enhanced by the road infrastructure described in this reasonably foreseeable scenario, but it is not quantifiable.

II.D.4. Spill-Response Training and Research Activities

There likely would be annual summer oil-spill-response training, which could involve 20-40 individuals for 1-2 days each summer at each anchor facility. There would likely be an increase in aircraft landings and take offs and, if the facility is near water, there likely would be increase watercraft activity.

Boats and other watercraft could be used by researchers during study efforts if facilities, or areas of concern, were located near large waterbodies such as the Beaufort Sea, rivers, or large, deepwater lakes. These activities would occur during the summer months, but their numbers, locations, and type of activities remain speculative.

II.E. Abandonment and Restoration of Production Sites

Abandonment and reclamation of satellite fields likely would coincide with abandonment and reclamation of corresponding anchor development sites. Abandonment operations include removal of all equipment, cutting well casings a minimum of 3 feet below the surface, and plugging wells. Gravel, or gravel/sand pads would not be removed but allowed to bed naturally. Overall, abandonment operations would take many years, as revegetation and environmental monitoring studies continue to document the long-term effects of operations at a particular site. A series of permitting and inspection activities are associated with abandonment procedures (Stipulation G-1). Abandonment activities would occur during winter months when ice roads could be constructed to allow the removal of equipment. Monitoring abandonment would require periodic revisits to gather information on environmental parameters related to natural bedding and to document success of abandonment actions. Normally, one helicopter with a crew of three would visit the sites annually for the first 5 years followed by increasing time gaps over the next 10 years. Site visits would include a maximum of 1 day per visit, and one visit/year.

II.F. Lease Stipulations and Required Operating Procedures

The Preferred Alternative includes mitigating measures that are designed to reduce the potential take of spectacled and Steller's eiders. These measures are either stipulations (conditions that apply to the lease) or required operating procedures (requirements that would apply to permits for activities associated with oil and gas operations). The full text for all stipulations and required operating procedures is given in Table II-03. Those stipulations and required operating procedures directly applicable to mitigate take of eiders are summarized in the following:

- Requiring surveys in the vicinity of proposed developments to prevent the taking of spectacled and Steller's eiders, which are listed as a threatened species under the Endangered Species Act, thereby reducing incidental take by establishing better baseline information on the species near developments.

- Requiring all utility and communications lines to be buried in access roads or installed on the pipeline VSM's.
- Requiring all facilities greater than 20 feet in height to have special lighting protocols. All communication towers, antennas, and similar facilities requiring support wires would be required to have markings to make support wires more visible to low-flying birds.
- Requiring all facilities to be designed to prevent the nesting, denning, etc. of predatory species including gulls, ravens, raptors, foxes, bears, etc.
- Requiring lessees to develop oil-spill-response plans prior to any exploration or development drilling.
- Relocating drilling pads and facilities, if necessary, up to 2 miles from optimum pad location (the current North Slope maximum extended reach is 4 miles and a 2.5 departure ratio), if surveys indicate relocation is necessary to avoid take.
- Imposing restrictions on the establishment of permanent or temporary facilities on all deepwater lakes (lakes with depths greater than 7 feet) and prohibit permanent facilities within ¼ mile of such lakes. No permanent facilities would be permitted in the streambeds of rivers. A no permanent surface occupancy setback of ½ mile would be imposed on all major rivers (measured from the centerline of the river as determined by current hydrology at the time of application). Along rivers or river segments where subsistence concerns have been raised, setbacks for no surface occupancy increase to ¾ mile.
- Limiting activities along the entire coastal area of the *Planning Area*. Permanent support facilities would be located at least ¾ mile inland from the coastline to the extent practicable. When technological limitations, economics, logistics, or other factors require that a facility be located within ¾ mile inland of the coast, the practicality of locating the facility at previously occupied sites such as the former Cape Simpson DEW-line sites would be considered. Use of existing sites within ¾ mile of the coastline also would be acceptable where it is demonstrated that use of such sites would reduce impacts to shorelines or otherwise be environmentally preferable.
- Limiting seasonal activities on Dease Inlet, Admiralty Bay, Elson Lagoon, and associated barrier islands, by allowing oil and gas exploration activities to take place only between October 15 and May 15 of each year. Special stipulations would be imposed for exploration and development, including a setback ¾ mile from shoreline seaward and around natural islands (excluding the barrier islands) within which no development could occur on or under the water. Standards that would have to be met before authorization would be granted for permanent facilities within the setback area would be intentionally set high, with the burden of proof resting with the lessee to demonstrate that approval by BLM is warranted. These standards address specific concerns raised by the North Slope Borough, local communities and residents about conflicts between oil and gas activities and seasonal concentrations of fish, wildlife, and waterfowl that frequent the area; associated subsistence uses and access on these important waterbodies; navigation hazards; spill-response capabilities; and special consultation procedures.
- Recommending the designation of the 102,000-acre area of Kasegaluk Lagoon as a Special Area with a prohibition on permanent surface occupancy (i.e., development facilities and staging areas).
- Restricting overland travel and associated activities for permitted uses.
- Confining recreational off-highway vehicle (OHV) use to winter use for snow machines and other low-ground-pressure vehicles. Within the NPR-A, no summer recreational use of OHV's would be permitted. The summer use of OHV's, including all-terrain vehicles (ATV's) and airboats, to support traditional subsistence activities and access would be allowed. The use of airboats during the summer would be limited to streams, lakes, and estuaries that are otherwise seasonably accessible by propeller- or jet-powered motorboat. To prevent impacts to soils, water quality, vegetation, and wildlife (especially nesting waterfowl), airboat use in areas of seasonal flooding of tundra and temporary shallow waters adjacent to streams, lakes, and estuaries would be prohibited.
- All facilities would be removed and rehabilitate to the satisfaction of the AO.

II.H. Private Lands

While there are private lands owned by the Arctic Slope Regional Corporation (ASRC) in the Northwest NPRA area, the best available geologic information about these areas is from the two existing gas fields near Barrow. Currently, the area is thought to be gas prone and, without a transportation system to a larger market, it is unlikely that there would be extensive interest in leasing and developing those lands at this time. The development of ASRC lands is considered to be speculative at this time, but the potential construction of pipelines and support facilities associated with development of fields in the Northwest Planning Area would reduce the potential development costs of oil and gas fields on private lands.

II.I. Other Key Assumptions

The North Slope Borough would be able to tax and receive income from the development of any oil and gas resources developed from these proposed activities. These taxes would add to the income available to the Borough for capital expenditures or to fund Borough operations. However, these potential projects would come on board at the same time income other taxable projects, such as Prudhoe Bay, are declining. It is likely the additional income from these projects would offset the loss of income from fields that are declining or have reached abandonment. While this income would be positive and beneficial, and would likely help maintain the current level of government activity and capital expenditure, it is unlikely to create a significant change in the growth rate of the communities on the North Slope.

III. DESCRIPTIONS OF LISTED EIDERS OCCURRING IN THE NORTHWEST NPR-A

III.A. Spectacled Eider

III.A.1 Population Status

The spectacled eider was listed as a threatened species in May 1993 (58 [*FR*] 27474) because of significant declines in the North American breeding population, particularly on the Yukon-Kuskokwim (Y-K) Delta. From the early 1970's to the early 1990's, numbers of pairs on the Y-K Delta declined by 96% from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al., 1993; Petersen et al., 1999). On the North Slope, the mean numbers of breeding spectacled eiders estimated from aerial surveys between 1993 and 2002 ranged from a high of almost 9,300 in 1993 to a low of 5,800 birds in 1996 and back up to 6,662 birds in 2002 (Larned et al. 2001a; Larned, Stehn, and Platte, 2003). A minimum (uncorrected for detection bias) long-term average (1992-2002) of 6,896 spectacled eiders occupied the surveyed portion of the ACP of Alaska (Larned. Stehn, and Platte, 2003), about 2% of the estimated 375,000 world population (Larned and Tiplady, 1999; USDOI, FWS, 1999). Most of the world population breeds in arctic Russia. Nonbreeders are not included in the Alaska estimate. They are assumed to remain at sea throughout the year until they attempt to breed at 2-3 years. The size of this population segment is unknown, as is their location during this period. Available life-history information for this species indicates they are long lived with relatively high adult survival and delayed sexual maturity. The Eider Survey area population has shown a nonsignificant decreasing trend of about -1.26% (slope) from 1993-2002 with a corresponding mean growth rate of 0.99 (Larned, Stehn, and Platte, 2003). Additional details of population status and annual cycle may be found in Petersen et al., (2000) and USDOI, FWS (1999a).

III.A.2. Spring Migration

Routes traveled by spectacled eiders during spring migration are not well known. Generally, they have been recorded passing Point Barrow and/or arriving at the breeding areas in late May to early June (Johnson and Herter, 1989). Although leads are important for many species migrating in this region, few spectacled eiders have been recorded using the lead system 5-6 kilometers offshore extending eastward from Point Barrow (Suydam, pers. commun., as cited in TERA, 1999; Woodby and Divoky, 1982). Suydam et al. (1997) recorded 55 spectacled eiders among 213,477 king and common eiders passing Point Barrow in spring 1994. Low numbers (0.5-0.7 birds per hour) have been recorded at several points in Simpson Lagoon (Johnson and Richardson, 1981), but some of these probably were movements of local birds rather than migrants. Thus, because relatively few spectacled eiders are seen in marine areas, spring migration may be primarily overland from the Chukchi Sea (TERA, 1999). Local observations that spectacled eiders flew inland north of Wainwright, reported by Myres (1958), support this view. They arrive on the breeding areas paired, often traveling in small flocks in late May and early June. Spectacled eiders have been observed to fly generally at altitudes less than 50 meters when over (marine) water (Petersen, Grand, and Dau, 2000).

III.A.3 Nesting

Currently, primary nesting grounds are the Y-K Delta; the ACP (Cape Simpson to the Sagavanirktok River) of Alaska; and in the Chaun Gulf and the Kolyma, Indigirka, and Yana river deltas of arctic Russia. With the exception of a few scattered areas in the northwest NPR-A, spectacled eiders occur at low density on the ACP (Larned et al., 2001b; Larned et al., 2001a; Ritchie and King, 2002). The highest densities determined from FWS aerial surveys in 1998-2001 were found within 70 kilometers of the coast between Barrow and Wainwright, with smaller areas northeast of Teshekpuk Lake (USDOI, BLM and MMS, In prep.:Map 62). Overall density was determined to be 0.24 birds per square kilometer in the Eider Survey area, based on observations of 304 birds in 2001 (Larned et al., 2001a; Larned, Platte, and Stehn, 2001), and 0.22 in 2002 (Larned, Stehn, and Platte, 2003). Before nesting, eiders occupy a variety of wetland and aquatic habitats (Anderson, Stickney, and Ritchie, 1996). Available information suggests female spectacled eiders return to the vicinity of previous nests. Spectacled eiders are dispersed nesters (Derksen, Rothe, and Eldridge, 1981; Warnock and Troy, 1992), occurring at a low density of 0.03-0.79 birds per square kilometer (Larned and Balogh, 1997) within about 70 kilometers of the coast. Higher density nesting and broodrearing areas occur south of Peard Bay, including the Kugrua and Kungok river drainages; south of Barrow; and adjacent to Dease Inlet, including the Meade, Chip, and Inaru river drainages. Tundra-nesting habitat most often includes extensive wetlands (large shallow lakes, lake-basin wetland complexes) with emergent sedges and grasses and vegetated islands (Larned and Balogh, 1997; Stickney and Ritchie, 1996). On the Colville delta, nearly half of the nests located were in salt-killed tundra and aquatic sedge with deep polygons (ABR, Inc., 2002). On the ACP, nesting begins in mid-June. Incubation lasts 20-25 days (Dau 1974, Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995), and eggs hatch from mid- to late July (Warnock and Troy, 1992). Broodrearing in the central ACP occurs primarily in waterbodies with margins of emergent grasses and sedges, basin wetlands, and deeper lakes (ARCO Alaska, Inc., 1996). Fledging occurs approximately 50 days posthatch.

On the nesting grounds, spectacled eiders occupy terrestrial wetlands and feed primarily by dabbling in shallow freshwater or brackish ponds, or on flooded tundra (Dau 1974, Kistchinski and Flint 1974). Food items include mollusks; insect larvae such as craneflies, trichopterans, and chironomids; small, freshwater crustaceans; and plants or seeds (Cottam 1939, Dau 1974, Kistchinski and Flint 1974, Kondratev and Zadorina 1992; Petersen, Grand, and Dau, 2000).

III.A.4. Postnesting Period

Most male spectacled eiders depart the nesting areas from early June to early July (median date June 22 ±11 days) typically soon after females begin incubating. The number of pairs peaks in mid-June, and the number of males declines 4-5 days later (Anderson and Cooper, 1994; Anderson et al., 1995; Smith et al., 1994). Males migrate a median distance of 6.6 kilometers (average 10.1 kilometers) offshore, spending up to a week in marine waters (Petersen, Larned, and Douglas, 1999). Locations of satellite-transmitter-equipped males (Petersen, Douglas, and Mulcahy, 1995) in the Beaufort Sea have been primarily in the western Harrison Bay and western Simpson Lagoon areas (USDOI, BLM and MMS, In prep.:Map 63). A molt migration is undertaken to Ledyard Bay molting area along the Chukchi Sea coast southwest of Point Lay (Larned, Balogh, and Petersen, 1995), and flocks of molting and staging eiders have been observed in Peard Bay, Norton Sound, south of St. Lawrence Island, and the Russian Far East prior to moving to the Bering Sea wintering area from October to December. Initial locations for many of the birds that were captured initially in the Prudhoe Bay area have been in the Chukchi Sea, suggesting they migrated overland or occupied the Beaufort Sea only briefly (TERA, 1999). Although most males may make relatively little use of the Beaufort Sea prior to their molt-migration, at least in part due to the existence of little open-water habitat this early in the summer (TERA, 1999), for some individuals the Beaufort Sea may be an important staging and migration route for as much as a week or two (Petersen, Larned, and Douglas, 1999).

After nesting, most spectacled eider females with broods occupy coastal plain lakes with emergent grasses and sedges, or deep, open-water lakes. Departure from broodrearing sites for marine areas takes place on average August 29 (±10.5 days). However, departure of females takes place over an extended period from the third week of June through September, because females that fail to breed leave the nesting area early, those that lose their nests leave somewhat later, and those that lose broods leave still later (TERA, 1999). When females depart the ACP, much more of the nearshore zone is ice free than when males depart; this open water in marine habitat allows extensive use of the western Beaufort Sea. Locations of females equipped with satellite transmitters in the Prudhoe Bay area indicate they stage and migrate in the Beaufort Sea and, like some males, use Smith and Harrison bays. Aerial surveys in late August 1999 recorded four spectacled eiders, a female with two young and an individual of unspecified sex in western Harrison Bay (Stehn and Platte, 2000). In 2000, 13 female spectacled eiders tracked via satellite telemetry primarily used the western Beaufort (71% of all bird-days); however, areas near Stockton Island also were used extensively (17% of all bird-days) (Troy, 2003). Half the tagged Prudhoe females were relocated twice in the Beaufort Sea, indicating a residence time of at least 4 days. Most previously were thought to spend relatively little time in the Beaufort (TERA, 1999); however, these recent satellite-transmitter locations suggest they may remain in the Beaufort Sea for about 2 weeks (range 6-30 days; Troy, 2003). Although satellite-tagged females have been relocated more than 40 kilometers offshore in the Beaufort Sea (TERA, 1999), the median distance for migrating individuals is 16.5 kilometers offshore (average 21.8 kilometers) (Petersen, Larned, and Douglas, 1999).

Numbers of spectacled eiders staging in the Beaufort Sea before southward migration generally are unknown. It is likely that relatively few birds occupy this area at any given time. This is suggested by relatively low numbers of birds counted on offshore aerial surveys (estimated densities of 0.01-0.16 birds per square kilometer) (Fischer, 2001; Stehn and Platte, 2000), as well as by the relatively low proportion of initial and repeat locations in the Beaufort Sea (once movement of an individual began) of transmitter-equipped birds that were captured initially in the central Beaufort Sea area. Aerial surveys in the central Beaufort Sea in July 2000 located 143 eiders in the deeper waters of Harrison Bay, including one flock of 100 birds (Fischer, Tiplady, and Larned, 2002). A less intensive FWS survey (flight lines twice as far apart), covering the entire Beaufort coastline from Point Barrow to Demarcation Point in July 2001, located 15 spectacled eiders off western Simpson Lagoon, in outer Smith Bay, and off the Plover Islands east of Point Barrow (Fischer, 2002; USDOI, BLM and MMS, In prep.:Map 62). These studies suggest that relatively low numbers of spectacled eiders typically would be expected to be found in either Beaufort or Chukchi seas during the staging/migration period from late June to September. However, these observations may underestimate numbers, because the limited aerial surveys may not accurately assess use of the entire area, and a substantial proportion of the "unidentified" eiders may have been spectacled. Observations made offshore in the Beaufort Sea by Divoky (1984) suggested that larger flocks may contain hundreds of individuals of this species. Divoky found the largest sitting flocks to contain more than 100 birds and flying flocks more than 300 individuals. During a late June-early July aerial survey in the Chukchi Sea between Peard Bay and Smith Bay, Dau and Anderson (2001) observed 40 spectacled eiders in nearshore waters. In 2002, they observed 10 in this area (Dau and Anderson, 2001), and Dau and Hodges (2003) observed 1 in 2003.

III.A.5 Nonbreeding Season

During the nonbreeding season the only known spectacled eider wintering area, from October/December to April, is among leads in the pack ice southwest of St. Lawrence Island in the Bering Sea (Petersen et al., 1999; Larned et al., 1997). Eiders forage there principally by diving to obtain benthic invertebrates at varying depths less than 80 meters. In the marine environment, they feed primarily on clams but also feed on snails, a variety of crustaceans, and members of various other taxa (Petersen, Grand, and Dau, 2000). In recent studies in the northern Bering Sea wintering area, esophagi of sampled eiders contained only clams, mostly *Nuculana radiata*, with no trace of the once-dominant *Macoma calcarea* (Lovvorn et al., 2003). Changes in density of the latter species in the Bering Sea were coincident with an oceanic regime shift to warmer conditions. Climate change at northern latitudes and associated changes in marine invertebrate communities and ice dynamics in spring may have had important impacts on the spectacled eider population whose declines of 90% or more in western Alaska essentially are unexplained.

Because few eiders are observed in marine areas along the Beaufort coast in spring, a majority may migrate to the nesting areas overland from the Chukchi Sea (TERA 1999). Although their location during the 1- to 2-month period between departure from the wintering area (April) and arrival in breeding areas in early June is unknown, it probably includes leads and polynyas nearest to the breeding areas (Lovvorn et al., 2003).

III.A.6. Factors Affecting Population Status

Factors known or suspected to affect survival of spectacled eiders have been identified, but the relative importance of these factors to the species' decline and to recovery are not known. The extent and causes of population declines or extirpations on the breeding grounds are difficult to assess, because historical data are lacking for many locations. Several of the following factors are known to affect survival during the nesting season, but it is not clear whether they contributed to the decline of the spectacled eider population.

Lead ingestion from foraging habitat on breeding grounds in the Y-K Delta has been confirmed to cause mortality of eiders that ingested lead shot. Spent shot pellets are ingested as grit or are accidentally ingested by eiders foraging in sediments for food. The grinding action of the eider's gizzard, in combination with the acidic environment of its digestive tract, causes toxic lead salts to be released into the body. On the Y-K Delta's lower Kashunuk River drainage, the proportion of spectacled eiders that contained lead shot in their gizzards is high (11.6%, n=112) compared to other waterfowl in the lower 48 states from 1938-1954 (8.7%, n=5088) and from 1977-1979 (8.0%, n=12,880). The lead-exposure rate in spectacled eiders (based on x-rays) is likely biased low (Flint, Petersen, and Grand, 1997), because lead is retained in the gizzard for only about 3 weeks (Elder, 1954; Dieter and Finley, 1978; Anderson and Havera, 1986; Franson, 1986; Anderson, Havera, and Montgomery, 1987). Blood analyses of spectacled eiders indicate elevated levels of lead in 13% of prenesting females, 25.3% of females during hatch, and 35.8% during broodrearing. Nine of 43 spectacled eider broods (20.9%) contained one or more ducklings exposed to lead by 30 days after hatch (Flint, Petersen, and Grand, 1997). Spent lead shot in the lower Kashunuk River area and on Kigigak Island is causing additive mortality in spectacled eiders; that is, mortality over and above that caused by natural circumstances (Grand et al., In press). It is possible that exposure to lead also occurs in small, localized hunting areas on the North Slope; but there are no site-specific data on lead contamination in this region.

Predation pressure on spectacled eider eggs, young, and adults may have increased in recent decades. Predators include arctic foxes (*Alopex lagopus*), red foxes (*Vulpes fulva*), large gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and snowy owls (*Nyctea scandiaca*). On Kigigak Island in the Y-K Delta, nest success ranged from 20-95% in 1991-1995 (Harwood and Moran, 1993; Moran and Harwood, 1994; Moran, 1995; Moran, 1996). Nest success may have been higher in 1992 than in other years of observation, because foxes were eliminated from the island prior to the nesting season that year. Native elders on the North Slope believe that fox numbers have increased in recent decades as a result of reduced trapping; this could have an important effect on rates of eider predation. Population sizes of large gulls on the North Slope may have increased as a result of increased food supplies from anthropogenic wastes (Larned et al., 2002). Wastes made available from the commercial-fishing industry in the Bering Sea and North Pacific, along with an increase in the garbage generated by coastal communities, have increased the year-round food supply for gulls.

Subsistence harvest of spectacled eider eggs and adults is another potential factor in the decline of the spectacled eider population. Alaskan Natives have traditionally harvested eiders and their eggs in coastal villages during spring and fall. Subsistence-harvest surveys for the North Slope indicate that an average of 155 spectacled eiders were taken at Wainwright for 1988-1989, and only 2 spectacled eiders were reported taken at Barrow in 1987-1990 (Braund, 1993). Yup'ik Eskimos on the Y-K Delta have traditionally harvested spectacled eiders for subsistence purposes (Klein, 1966). Although the human population on the Y-K Delta has grown substantially, changes in the number of active hunters are unknown. Similarly, available harvest technologies have become increasingly efficient, but the actual effects of new technologies on harvest levels are unknown. The estimated harvest of spectacled eiders on the Y-K Delta from 1992-1995 averaged 272 birds per year (Service, 1996, unpublished data); the 1992-2001 average is 123 (Service, 2002, unpublished data).

There are other sources of take such as avicultural egg collecting (until 1991), research activity, and loss of habitat in growing communities and oil fields. Their overall impact on the spectacled eider population is unknown.

Other potential factors that may affect spectacled eider survival have been suggested but not investigated. These include changes in the invertebrate community structure in their winter habitats, bioaccumulation of contaminants in the marine environment, human harvest for sport and subsistence outside their breeding grounds, disease, parasites, and accidental strikes and/or disturbance of benthic feeding areas by commercial-fishing activity.

III.B. Steller's Eider

The Alaska-breeding population of Steller's eider was listed as threatened on June 11, 1997 (62 *FR* 31748-31757). This action was based on a substantial decrease in the species' nesting range in Alaska, a reduction in the number of Steller's eiders nesting in Alaska, and the resulting increased vulnerability of the remaining breeding population to extirpation. Historically, Steller's eiders nested in Alaska in two general regions: western Alaska where the species has been nearly extirpated, and the ACP where the species still occurs. In western Alaska, Steller's eiders occurred primarily in the coastal fringe of the Y-K Delta where the species was common at some sites in the 1920's, was still present in the 1960's, but was not recorded as breeding from 1976-1994 (Kertell, 1991; Flint and Herzog, 1999). In 1994 and 1996-1998, one to two nests were found at either or both the Tutakoke River and Hock Slough study sites on the Y-K Delta (Flint and Herzog, 1999).

On the ACP, Steller's eiders historically occurred from Wainwright east, nearly to the United States-Canada border (Brooks, 1915). The species may have abandoned the eastern ACP in recent decades, but it still occurs at low densities (0.01 per square kilometer; Larned et al., 2001; Larned, Stehn and Platte, 2003) from Wainwright to at least as far east as Prudhoe Bay (USDOI, BLM and MMS, In prep.:Map 63). The majority of sightings in the last decade have occurred east of Point Lay, west of Nuiqsut, and within 90 kilometers (56 miles) of the coast (Barrow Triangle). Near Barrow, Steller's eiders still occur regularly, although they do not nest annually. In some years, up to several dozen pairs may breed in a few square kilometers. The species has been found at highest density (0-3.0 pairs per square kilometer) during road surveys in the core nesting area near Barrow (Quakenbush, et al., 1995; USDOI, FWS, 1999). Intensive surveys in the area between Admiralty Bay and the Chukchi Sea from 1999-2001 recorded densities of 0.02-0.08 birds per square kilometer (44-112 birds observed during 3 years) (Ritchie and King, 2002). In 2002 and 2003, respectively, these investigators recorded an indicated total of 4 birds and 8 birds and a density of less than 0.01 birds per square kilometer (Ritchie and King, 2003; Ritchie, 2003, pers. commun.).

Contemporary aerial breeding-pair surveys conducted in late June indicate a population averaging about 1,000 birds from 1986-2000 (Mallek, 2001). A separate set of aerial surveys, timed in mid-June, indicates a smaller population, averaging about 200 birds from 1993-2001 (Larned et al., 2001a). These surveys likely underestimate actual population size, however, because an unknown proportion of birds are missed when counting from aircraft, and no species-specific correction factor has been developed and applied. Nonetheless, these observations indicate that hundreds or low thousands of Steller's eiders occur on the ACP. These surveys do not demonstrate a significant population trend over the last decade. However, based on the observed interannual variability, it is estimated that it would take 14 years to detect a trend equivalent to a 50% change over 10 years (Larned et al. 2001b). Current sampling intensity is too low to provide useful trend data for this very rare species. There is some support for the hypothesis that Steller's eiders have abandoned formerly occupied areas and have reduced their breeding frequency in eastern portions of the ACP; if true, this likely indicates that the Alaska breeding population is in decline (Quakenbush et al., 2002).

Steller's eiders spend most of the year in marine habitats. During winter, most of the Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, nearshore marine waters (Jones, 1965; Petersen, 1980). They also occur in the western Aleutian Islands and along the Pacific coast, occasionally to British Columbia, along the Asian coast (from the Commander Islands to the Kuril Islands), and some are found along the north Siberian coast west to the Baltic States and Scandinavia (Palmer, 1976; Cramp et al., 1977). In spring, large numbers concentrate in Bristol Bay before migration; in 1992, an estimated 138,000 Steller's eiders congregated there before sea-ice conditions allowed movement northward (Larned, Butler, and Balogh, 1994).

Steller's eiders arrive paired on the ACP in early June. Nesting effort varies widely from year to year. In the 12 years from 1991-2002, there were 6 "nesting years" (1991, 1993, 1995, 1996, 1999, 2000) when typical breeding activities occurred, and 6 "non-nesting years" (1992, 1994, 1998, 2001, 2002) when birds appeared in early summer, but no nests were found and Steller's eiders are believed not to have nested (Quakenbush et al., 1995; Obritschkewitsch et al., unpublished data). Four nests were found in 1997, but these were initiated late (early July) and none survived past mid-incubation (Service/North Slope Borough, unpublished data). The reasons for the observed variation in nesting effort are unknown, but an association has been noted between nesting years and years of lemming abundance. Nest success could be enhanced in years of lemming abundance, because predators are less likely to prey on eider nests when small mammals are abundant. It also has been hypothesized that avian predators such as pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Nyctea scandiaca*), which nest at high densities only when lemmings are abundant, may provide protection for nearby eider nests incidental to defense of their nesting territories (Quakenbush and Suydam, 1999). If this hypothesis is correct, the presence of avian predators is an essential element of breeding habitat.

In nesting years, initiation dates are typically in the first half of June (Quakenbush et al., 1995), and hatching dates range from 7 July to 3 August (Quakenbush et al., 1998). Nests in Barrow are located in wet tundra, in areas of low-center polygons or low (indistinct flat-centered) polygons, frequently within drained lake basins (Quakenbush et al., 1998). Average clutch sizes at Barrow ranged from 5.3-6.3 in five different years, with clutches up to 8 reported (Quakenbush et al., 1995). Nest success (proportion of nests at which at least 1 egg hatched) at Barrow averaged approximately 17% from 1991-2001 (Service, unpublished data). Egg loss was attributed mostly to predation by predators including jaegers, common ravens (*Corvus corax*), and possibly glaucous gulls (*Larus hyperboreus*) and arctic foxes (*Alopex lagopus*) (Quakenbush et al., 1995; Obritschkewitsch, Martin, and Suydam, 2001). The fledging period is not known, but is estimated to be 37 days (Obritschkewitsch, Martin, and Suydam, 2001). Broods most often used ponds with emergent grass (*Arctophila fulva*) (Quakenbush et al., 1998). Broods were reared close to their nest site; eight broods tracked near Barrow in 1995 remained within 650 meters of their nest sites during the first 12 days after hatching (Quakenbush et al., 1998).

Males typically depart the breeding grounds after females begin incubating. Based on observations in the Barrow area, and on a small sample of birds equipped with satellite transmitters, males depart Barrow around the end of June or early July (Quakenbush et al., 1995, Obritschkewitsch, Martin, and Suydam, 2001). Both males and females tracked with satellite transmitters in a nonbreeding year dispersed across the area between Admiralty Inlet and Wainwright in late June and early July, with most birds entering marine waters by the first week of July. The satellite-tracked birds used coastal locations from Barrow to Cape Lisburne and made extensive use of lagoons and bays on the north coast of Chukotka (Service, unpublished data). Visual observations in other years confirm the use of nearshore areas of the Chukchi Sea; small groups of males (fewer than 10) have been observed in July near Barrow (USFWS, unpublished data). Females that fail in breeding attempts may remain near Barrow later in the summer; a single failed-breeding female equipped with a transmitter in 2000 remained near the breeding site until the end of July and stayed in the Beaufort Sea off Barrow until late August. Females and fledged young depart the breeding grounds in early to mid-September.

In mid-August, Alaska-breeding Steller's eiders migrate to molting areas, where they congregate in large flocks in protected waters. Concentrations of molting Steller's eiders have been noted in Russia on the Chukchi and Bering sea coasts, near St. Lawrence Island in the Bering Sea, and along the northern shore of the Alaska Peninsula (Kistchinski, 1973; Fay, 1961; Jones, 1965; Petersen 1981). Satellite-tracked birds from Barrow molted at Nunivak Island, Cape Avinof (Kuskokwim Shoals), Nelson Lagoon/Port Moller, and Izembek Lagoon (USFWS, unpublished data).

Causes of suspected population declines are not known. Possible causes currently being examined include community dynamics of nesting avian populations in the Barrow area, artificial increases in predator populations on the North Slope, subsistence harvest, and ingestion of lead shot.

III.C. Critical Habitat

The FWS designated approximately 101,000 square kilometers (38,992 square miles) on the Y-K Delta and in Norton Sound, Ledyard Bay, and the Bering Sea between St. Matthew and St. Lawrence Islands as critical habitat for the spectacled and Steller's eiders, on February 2 and February 6, 2001, respectively (66 *FR* 8850 and 9146). The only area designated in the Arctic is Ledyard Bay, a spectacled eider molting area in the southeast Chukchi Sea, northwest of Cape Lisburne and south of Point Lay, and the westernmost portion of the Northwest NPR-A Planning Area. The Bering Sea marine area, the only known wintering area for spectacled eiders (Petersen, Larned, and Douglas, 1999), includes organisms in the water column and the underlying bottom community where these bottom-feeding ducks forage in depths of at least 70 meters (Petersen, Piatt, and Trust, 1998).

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IV. ASSESSMENT OF EFFECTS ON LISTED EIDERS

IV.A. Effects from Non-Oil and Gas Activities

Subsistence harvesting of spectacled and Steller's eiders is continuing across the North Slope (USDOI, FWS, 2002). Efforts currently are under way by both FWS and the North Slope Borough to inform subsistence hunters of harvest closures in an effort to decrease this source of mortality. This type of harvest is most pronounced in the immediate area of villages. It is not known what the overall impact this activity has on either species of eider.

Lead-shot contamination (nontargeted, but residual effect of general waterfowl hunting) of spectacled and Steller's eiders has been documented near Barrow, and the Y-K Delta (USDOI, FWS, 2002); however, the extent of this contamination is not defined at this time.

The National Marine Fisheries Service (2002) reported that within the marine range of the Steller's eiders, the marine environment likely has been affected by human activities including commercial-fishing, marine-transport, and environmental pollutants. However the FWS (66 *FR* 8850) has no evidence that modification of the marine environment has contributed to Steller's eider decline. Naturally occurring ecosystem changes also may result in a decline in available food supply for Steller's eiders (National Marine Fisheries Service 2002), but the extent is not known.

Human population growth (unrelated to oil development) around villages and the regional hub of Barrow leads to some nesting habitat loss for Steller's eiders in expansion of housing areas into previously open areas (Quakenbush and Suydam, 1999). This habitat loss, and related human activity also may lead to increases in predator populations (ravens, gulls, foxes, etc.) (National Marine Fisheries Service, 1993).

IV.A.1. Effects of Ground Activities

Most ground transport activities occur in winter and thus would not disturb eiders or affect their habitats. However, during the summer breeding season, noise and visual presence of humans resulting from various activities may disturb eiders. Eiders are likely to be displaced from within about 0.2-1.0 kilometers of large summer encampments, potentially causing a local decline in nest attempts and success (Grubb et al., 1992; Johnson et al., 2003; Murphy and Anderson, 1993; Skagen, Knight, and Orians, 1991; Stalmaster and Newman, 1978). Under the Preferred Alternative, occupation of large research or inventory camps is anticipated to be 12 weeks (Table IV-28). Eiders displaced when a camp is initially occupied would not be likely to return to the area after such camps are abandoned because of a short breeding/rearing season in the Arctic. Lack of male availability at the end of these periods also would limit success. Local spectacled eider populations may experience minor declines in breeding success due to disturbance in summers when camps are occupied. This scenario may not be as relevant to Steller's eiders, because they are distributed more sparsely within the Planning Area than spectacled eiders, and their attempts at nesting appear more sporadic.

Predators attracted to camps may decrease breeding success of local nesting eiders. Effects of small, frequently moved camps are likely to be negligible (Table IV-28) but may result in minor, localized loss of nest success and productivity. Small groups of travelers on the Colville and other rivers at the frequency anticipated are expected to cause negligible disturbance of eiders.

IV.A.2. Effects of Aircraft

Both fixed-wing aircraft and helicopters could be used to transport personnel, supplies, and equipment into summer field camps and to conduct aerial surveys. Helicopter activity has a potential to cause substantial disturbance of eiders, although Balogh (1997) indicated that fixed-wing aircraft flown at 150 feet often caused spectacled eiders to flush, while helicopters flown at similar altitudes in the vicinity of Prudhoe Bay did not. Behavioral reactions of prenesting birds to aircraft overflights may not be representative of behavior of incubating or broodrearing birds. It is possible that some eiders may be disturbed by these activities and experience temporary, nonlethal effects. Effects of routine aircraft flights into large camps may range from causing avoidance of certain areas by eiders to abandonment of nesting attempts or lowered survival of young. Regardless of where they originate, such flights may pass over areas where eiders occur at higher density. There is a potential for displacement of some nesting eiders near routinely used aircraft landing sites as a result of numerous overflights, landings, and takeoffs. However, although the reaction of eiders to aircraft overflights is unknown, there is a potential for habituation to routine air traffic by spectacled eiders. In the Prudhoe Bay area, nests are located regularly in wetlands within 1 kilometer of the Deadhorse Airport (TERA, 1995), including one less than 250 meters from the runway (Martin, 1997), suggesting that some nesting individuals are tolerant of aircraft activity.

Low-level (less than 500 feet aboveground level) aerial survey flights for monitoring bird or caribou populations have an unknown effect on eiders. In general, however, disturbance of a particular area is of short duration, and surveys cover only a small percentage of the Planning Area each season. It is anticipated such flights would cause negligible disturbance of eiders. In the northeastern portion of the NW NPR-A Planning Area, wildlife survey activity may be more frequent during a 3-week period in June and July (Table IV-28), thus disturbing larger areas or certain areas more intensively than elsewhere in the Planning Area. Eiders may be disturbed by helicopters used for studies in which caribou are captured for attachment of radio collars. Other aerial surveys and point-to-point air traffic are likely to cover a small percentage of the Planning Area. Relatively few nest sites are expected to be affected, because eider nest sites generally are scattered at relatively low density over much of the northern half and west-central portion of the Planning Area, and at even lower density in the remainder. In most areas, aircraft effects are likely to be short-term and negligible, although potentially minor effects could occur in the vicinity of large camps located in eider higher density areas. Quantitative effects resulting from aircraft activity are difficult to separate from natural variation in population numbers.

IV.B. Effects from Oil and Gas Leasing and Exploration

Under the Preferred Alternative, all BLM-administered lands in the Planning Area would be available for leasing. However, leases in the proposed Deferral Area (17 % of the Planning Area) would not be offered for at least 10 years following the Record of Decision for the NW NPR-A IA/EIS. Seismic surveys could occur anywhere in the Planning Area during any winter, depending on the interests of the oil industry and approval by BLM. Exploration drilling would occur only where oil/gas leases are purchased. It currently is unknown where these activities would occur, but it is assumed industry would focus primarily on the area of high potential (Map 105). This discussion of potential effects is based on levels of activities considered reasonably foreseeable (see Section II).

Spectacled eiders are widely distributed throughout the ACP portion of the Planning Areas during summer months but are absent from the areas from October to May, when most oil exploration would occur.

Steller's eiders are widely scattered in low numbers over most of the ACP portion of the Planning Area in summer, with an area of higher concentration south of Barrow between Dease Inlet and the Chukchi Sea. Human presence and associated noise and activities (including aircraft and marine vessel traffic) may disturb both species of eider.

IV.B.1. Seismic Surveys and Exploration Drilling

Seismic surveys and exploration drilling would occur in winter (generally December to May) when eiders would be absent; thus, no direct impact to eiders would occur. There would be no disturbance effect on breeding eiders or risk of eider mortality due to collision with structures. All garbage from these operations would be removed to existing Borough landfills, sometimes after being incinerated on site. This would preclude the attraction of predators that otherwise may linger in the area until after eiders arrive in early summer. With the exception of a blowout occurring during exploration drilling (for such an unlikely event, it is assumed none would occur [USDOI, BLM and MMS, In prep. Table IV-7]), any spills would be refined petroleum products or antifreeze and would be site contained. In a frozen environment, such spills would be cleaned up immediately to a level that would have no effect on eiders the following summer. Ice roads, built to support exploration activities, may increase access to an area for subsistence hunters in the winter but would have no effect on increased access during summer months.

Indirect impacts on eiders could occur in summer as a result of winter exploration activities. Each seismic operation is prepared for summer storage on an existing gravel pad as near the previous winter's operation area, and the presumed area for continued operations the following winter, as possible. Exploration drill rigs would be moved at the end of the winter season either to an existing gravel pad and cold stacked, or cold stacked on a special ice pad designed to last throughout the summer into the next winter. Some negligible disturbance to eiders could occur from aircraft travel to these sites in summer, but the frequency of these flights (see Section II) would be low compared to other areas where impacts of air traffic have been studied (Johnson et al., 2003; Martin, 1977). The presence of maintenance personnel at the seismic camps in summer may cause some disturbance to eiders in the immediate vicinity of the gravel pad and, in the worst case, result in nest failure. However, only two such camps are reasonably foreseeable, and their footprint is small; they are expected to have a negligible effect on eiders.

Cold-stacked exploration drill rigs have a low profile (20 feet or less in height) and have a small footprint. It is unlikely the storage of this equipment would cause eider mortality due to in-flight collision. Predators would not be attracted to garbage at these cold-stack facilities, because all garbage is removed from the sites to approved Borough landfills. Any petroleum or chemical spill related to maintenance activities would be confined to the site and would not pose a threat to eiders. Cold stacking of equipment would provide no increased access for subsistence hunters.

Winter exploration activities and summer storage of a drill rig on an ice pad (5-6 acres) may alter habitats temporarily (e.g., compression of standing-dead vegetation, or delayed pheneology of vegetation due to late ice melt). This could affect the distribution of eiders occurring in or adjacent to the Planning Area in subsequent summer seasons. Impacts to vegetation are low overall (Jorgenson. Reitz, and Raynolds, 1996) and especially in wetter habitat that eiders frequent. Only a small portion of the tundra within the Planning Area is affected during any particular year, and eider habitat does not appear to be the limiting factor in population decrease. Overall, the impacts on eiders from summer storage of equipment on ice pads would be limited to possible short-term displacement and would have no measurable impact to eider populations.

The construction of ice roads in support of winter exploration drilling activities involves the withdrawal of millions of gallons of water from adjacent deepwater lakes. The effect, if any, of this withdrawal on invertebrate fauna in these lakes are unknown, but recent studies of water-level changes during and after winter water withdrawal have failed to show measurable change. The withdrawal of water from these deepwater lakes would not have an effect on eider population, because neither species selects deepwater lakes as their preferred habitat (USDOI, BLM, 2002).

IV.B.2. Marine Vessel and Aircraft Activity

During the summer open-water season (mid-July to early October), there could be some marine transportation of equipment and supplies needed for exploration. Barges may be used for transport because of logistic and economic issues associated with moving heavy equipment and materials, either by ice road or rolligon, over the long distances from current infrastructure. During the exploration phase, barges likely would be the preferred transport for exploration drilling rigs. If suitable staging areas do not already exist, new ones may be established along the coastline and materials transported and stockpiled for use at inland sites during winter operations. Vessel traffic generally would be limited to routes in shallow, nearshore, waters between staging areas connected to existing infrastructure (e.g., West Dock or Oliktok Point) and staging arras along the coastline in the Planning Area at Cape Simpson or Barrow. Spectacled and Steller's eiders that are accompanying young, or staging and migrating in coastal or offshore waters during the variable periods they are present in the Beaufort Sea (males and non-breeding females: late June/early July; failed nesting females: July-September; or females with juveniles: late August/September), could encounter vessels associated with oil and gas activities in the Planning Area. Because these birds are likely to dive or fly short distances to avoid close approach of vessels, there would be negligible disruption of foraging activity or rest periods because of the low probability of interactions with vessel movement.

Aircraft activity over the marine environment during the open-water season, as a result of exploration activities in the Planning Area, is expected to be minimal. There is a low probability these areas would be overflown by support aircraft during the brief staging/migration periods; thus, no consequential disruption of foraging or resting behavior caused by aircraft are expected.

IV.C. Effects from Oil and Gas Development and Production

IV.C.1. Habitat Loss

IV.C.1.a. Permanent Habitat Loss

Gravel mining operations most likely would be located on river drainages within the Planning Area. Depending on location and extent of each material site, overall effects could range from no eider habitat disturbed to a worst-case scenario eliminating up to 280 acres of known habitat (Table 1, Section II.C.2). Potential losses of habitat may include areas used during the entire period eiders are present in the Planning Area (prenesting, nesting, broodrearing, and molting). To eliminate eider habitat loss due to gravel mining, all such operations would have to occur outside the areas used by eiders during any portion of their stay in the Planning Area, which is unlikely. The actual location and extent of the gravel mining operations is unknown at this time. Gravel would be mined and transported to sites via ice roads during the winter when eiders are absent, so no affects would be incurred by eiders. Because no active mining would occur at sites during the time when eiders are present in the Planning Area, no zone of influence analysis is provided.

The actual gravel footprint needed for development of anchor and satellite facilities (including associated roads), a roadless pump station, and a staging areas would total 1,420 acres (Table 1). Areas covered by gravel are effectively eliminated as productive breeding and foraging habitats for wildlife, and this loss is considered permanent. Placement of gravel fill has a substantial impact on wildlife habitats in the Arctic, as the disturbance is long term and recovery of vegetation is slow (Johnson, 1987; Walker et al., 1987; Jorgenson et al., 1991). The ratio of eider habitat that would be lost to gravel placement and total eider habitat available in the Planning Area is unknown at this time, because neither the actual location of gravel placement nor the amount of eider habitat present in the Planning Area is known. It is reasonable to assume that within the Planning Area, there is sufficient eider habitat available for individual eiders displaced by gravel placement relocate successfully to other areas. A study by Troy and Carpenter (1990) found that in the Prudhoe Bay oil field, most birds (particularly shorebirds) that are displaced by gravel placement will nest in adjacent habitats in subsequent years. Spectacled eiders have been found to nest in the same general areas from year to year, but they do not always return to the same nest site (Johnson, 1995). Anderson et al. (2002) have located spectacled eiders nesting near roads and pads in some oil fields on the North Slope. Information of use of areas near oil field facilities is not available for Steller's eiders. When the total area of gravel fill is compared to the total acreage within the Planning Area and the apparent ability of spectacled eiders and other birds to relocate nests annually, the direct effects of gravel fill on spectacled and Steller's eiders is expected to be minor.

IV.C.1.b. Temporary Habitat Loss

Alteration of nesting habitat that results in its temporary loss could be caused by delayed snowmelt and compaction of vegetation in areas underlying ice roads used for transport of equipment and material for seismic surveys and snow dumps around pads during winter. Ice roads and associated snowdrifts may not melt before eiders begin nesting, thereby reducing the availability of nest sites. Compaction of standing-dead vegetation from previous growing seasons could degrade or eliminate concealing cover potentially used by eiders. Such temporary losses may adversely affect eiders, because they traditionally return to the same general nest area each year. Such effects could be compounded if ice roads cross the same area more than once. Efforts to decrease the compaction of vegetation could include routing ice roads over areas of nearshore ice, lakes, tidal flats, rivers, and streams to avoid damaging vegetation; altering the route of ice roads annually to avoid possible compounding the effects of compaction; and avoiding routing the ice roads over areas of known eider concentrations. Other temporary effects to habitat alter the patterns of use in an area. Habitats adjacent to oil field infrastructure (anchor and satellite pads, roads, staging area, etc.) would be affected by dust fallout, persistent snowdrifts, impoundments, thermokarst, and water withdrawal that would occur during the development and productions phases. These effects have the potential to alter use of these habitats by eiders. The magnitude of these impacts would depend on a variety of factors including habitat type, volume of ground ice, and local hydrology (Brown and Grave, 1979; Walker et al., 1987). The total area affected would be between 21,610 and 53,960 acres depending on the area of the zone of influence chosen.

The magnitude of effects from dust fallout would depend primarily on the intensity of vehicle traffic and aircraft takeoffs and landings and primarily would cause snowmelt in advance of surrounding areas, thermokarst, increased depth of seasonal thaw, increased soil pH, lower nutrient levels, and changes in the species composition of plant communities. Dust fallout would be expected to be greatest during the construction phase and would be reduced during the operational phase of the project. Advanced snowmelt due to the thermal properties of dust fallout on snow can have both positive and negative effects on eiders. Areas that are available early in the season will provide early access to open water and foraging areas. These areas, however, will be close to roads, airstrips, and pads, providing increased potential for collisions and vehicle strikes. Restricting the bulk of construction to the winter months, applying dust-control procedures, and reducing traffic of all types to a minimum should reduce dust fallout to a minimum level.

The magnitude of the effects of thermokarst (melting of permafrost) is directly related to the type and amount of disturbance to the tundra. The effects are caused primarily by alteration of the hydrologic regime in the area and include both positive and negative impacts to eiders. Murphy and Anderson (1993) found that waterfowl used an area disturbed by the building of a peat road more often than most other undisturbed habitats in Prudhoe Bay. Changes in the hydrologic regime of an area could cause impounding of water and loss of eider nesting habitat due to flooding. There are very little data available from which to draw conclusions about the impacts of thermokarst on eider habitat. The proportion of the Planning Area that would be impacted by thermokarst due to removal or alteration of the tundra would be small; thus, the impacts to eiders would be expected to be minor.

The construction of gravel roads, pads, and airstrips can cause changes in the hydrologic regime of an area and can result in impoundments. Impoundments can have both positive and negative effects on eiders. Positive effects include earlier access to ice-free areas due to impoundments being in areas near roads and pads, which often thaw earlier (Anderson et al., 2001). Impoundments also can preclude nesting by flooding of potential nesting habitat (Walker et al., 1987). Just as with thermokarst, the effects of impoundments are not well known in relation to effects on eider habitat. Assuming that eiders experience both positive and negative effects of impoundments and the relatively small amount of area covered by gravel roads, pads, and airstrips in the development plan, only minor impacts to eiders would result.

Withdrawal of water from lakes potentially could affect eiders due to alteration of hydrologic regimes resulting in reduced availability of nest sites. Small islands in lakes and areas of slightly raised tundra in wetlands are used by eiders for nesting, because they provide some protection from predators by virtue of being across an expanse of water. If the volume of water withdrawn is great enough, these island habitats would cease to exist and predators would have easier access to eider nests. Water withdrawal from lakes is regulated by ROP B-2, which was written primarily for the preservation of fish habitat but also would protect eider habitat by restricting the volume of water removed. Water withdrawal has potential serious effects on eider habitat availability and nest success. Large lakes often are chosen for water withdrawal and, because of their large volume, there often is little effect on the surface level. Water withdrawal often is conducted in winter, because water is need for construction of ice roads. Withdrawal in winter allows for spring breakup to recharge waterbodies. Water withdrawal in summer would have to be carefully monitored to ensure that water is not being removed form waterbodies that support nesting or broodrearing eiders.

IV.C.2. Bird Collision Hazard Related to Oil Development and Production Activities

The presence of drill rigs, production and support facilities, vehicles (trucks and aircraft), barges, and power and communication lines and towers all represent potential collision hazards to eiders. Extended day length during the nesting season suggests that such structures would be quite visible and easily avoided except potentially under conditions of rain or fog. Certain types of structure lighting in common use may amplify any tendency of eiders to approach and strike structures. Various oil and gas structures present collision hazards during low-light conditions; mitigation that requires exterior lights to be directed inward and downward (ROP E-10) may be required. Ongoing studies (ABR, Inc., Northstar Island) are attempting to determine the optimum lighting regime for both human safety and to minimize bird collisions. Close communication and cooperation between BLM, FWS, and oil companies as to the latest developments in lighting would help in continuing to improve lighting regimes to minimize collisions.

IV.C.2.a. Drill Rigs

A maximum of eight development drill rigs would be operating in the Planning Area during the time when eiders are present over a period of 6 years (Table IV-02). Rigs would be located on satellite pads and are approximately 60-80 feet in height when in operation. Drill rigs would occupy a very small proportion of the area occupied by eiders, so the collision hazard is thought to be negligible.

Production and support facilities would be located onshore on gravel pads, and could pose a collision hazard for eiders. Inter-tidal or offshore facilities are unlikely to exist due to the ¼ mile no surface occupancy requirement (Stipulation K-6). Proper lighting of structures during periods of poor visibility may help reduce the potential for collision. These facilities rarely exceed 30 feet in height, and human and vehicle activity around facilities may act as a deterrent to eiders and help to reduce the number of collisions. Number of collisions due to production and support facilities would be expected to be very small.

IV.C.2.b. Aircraft Collision Hazard Related to Oil Development and Production Activities

Aircraft operations present possibilities for collisions with eiders. Each of the two anchor facilities will have an associated airstrip which will be used by fixed-wing aircraft and helicopters. There will be substantial aircraft traffic during the development and a reduced amount during production (see Sections II.C.2.d and II.D.1). The U.S. Department of Agriculture, through an interagency agreement with the

Federal Aviation Administration (FAA), compiles a database of all reported bird/wildlife strikes to U.S. civil aircraft and to foreign carriers experiencing strikes in the USA. More than 38,000 strike reports from 1,300 airports have been compiled for 1990-2001 (about 5,900 strikes in 2000). The FAA estimates that this represents only about 20% of the strikes that have occurred. Aircraft collisions with birds are most prevalent during the takeoff and landing phases of flight, and the consequences of bird/aircraft collisions can be disastrous to both the bird and the occupants of the aircraft. Even though collisions between birds and aircraft occur the probability of a collision with an single eider is considered low, because most collisions are with flocks of birds (U.S. Dept. of Agriculture, Bird Strike Committee, web page 2003), and eider densities are low (1.11 birds/km^2 for spectacled eider and 0.06 birds/km^2 for Steller's eider).

IV.C.2.c. Terrestrial Vehicle Collision Hazard Related to Oil Development and Production Activities

The majority of vehicle traffic would occur in winter during development and would be greatly reduced during the period when eiders are present in the Planning Area. Vehicles would be used for travel between anchor and satellite pads to monitor wells and complete routine maintenance. Information regarding vehicle-caused mortality for the Kuparuk and Prudhoe Bay oil fields is not available, although the actual number of animals injured or killed is thought to be low. The number of eider mortalities from vehicle collisions is expected to be negligible, because the number of eiders in relation to all birds in the area is very small.

IV.C.2.d. Marine Vehicle Collision Hazard Related to Oil Development and Production

Spectacled and Steller's eiders that are accompanying young, or are staging or migrating in coastal or offshore waters during the staging/migration periods (late June/early July, late August/September), may encounter a few vessels associated with oil and gas activities in the Planning Area. Barges delivering equipment late in the open-water season may represent a potential collision hazard for eiders. One such case was documented in March 2001, when three spectacled eiders struck a research vessel in the northern Bering Sea wintering area under predawn light conditions (Lovvorn et al., 2003). The number of barges potentially using the area is so low (assumed up to 20) compared to the open-water area available for eiders that the potential for collisions from this source are considered to be very low.

IV.C.2.e. Power and Communication Structure Collision Hazard Related to Oil Development and Production

Power and communication lines will be buried in roads or installed on the pipeline VSM's. The combination of power and communication lines with the pipeline would present a single large, easy to detect obstacle potentially reducing the risk of collisions as compared to traditional communication and power lines strung on poles. Power and communication lines buried under the road would reduce potential collisions from these structures to zero. Studies conducted in the Lisburne Development Area showed that bird collisions with power lines were infrequent (Anderson and Murphy, 1988). Eiders likely would make up only a small component of these types of collisions, because they make up only a small proportion of the total number of birds in the area. Each anchor facility will have one communication tower, which may be up to 60 feet in height. All guy wires on communication towers would by marked (ROP E-11) to increase visibility and reduce the potential of collisions by eiders. It is expected power and communications lines and towers would pose a negligible hazard to eiders.

IV.D. Potential Effects of Increased Accessibility for Subsistence Hunting

IV.D.1. Birds Hunted in Previously Inaccessible Areas

The reasonable and foreseeable scenario depicts oil field developments within the Planning Area as being unconnected to other road systems. Nonetheless, there remains a possibility that the roads within a development may increase the access of local hunters to previously inaccessible areas. These roads would connect the secondary and satellite pads to the main pad of the anchor development. If a development were constructed so that its roads were within reach of the ATV trails extending south out of Barrow, hunters from Barrow might reach the road system of the development and use it for easy, motorized access to areas farther from Barrow. Alternatively, Barrow hunters that previously used the area by whatever means of access may avoid that area once a development is constructed. Some villagers of Nuiqsut say they have reduced their use of the Colville River Delta in the vicinity of the Alpine development since its construction.

Those hunters interested in harvesting waterfowl may be most attracted to this possible increase in access during the period immediately following spring breakup, when some hunters concentrate on geese and other returning birds. Although the FWS has made an effort to educate the local hunting public about the plight of spectacled and Steller's eiders, and has stated that the prohibition against harvest of these species would be enforced, some level of harvest may continue. It is unknown what that level is, or whether the increased access scenario depicted here would result in an increased harvest of spectacled or Steller's eiders in the Planning Area. It would be speculative to state how this would impact the eider populations other than to say there is a potential for an adverse impact.

IV.D.2. Lead-Shot Accumulation in the Environment

It currently is illegal to use lead shot for waterfowl hunting. Its lethal and sublethal effects from ingestion by eiders and other waterfowl are well established (e.g., Flint and Grand, 1997). The FWS and other agencies have made efforts to educate North Slope residents on this issue, and clinics have been held to train local hunters how to adjust to the different ballistics of steel shot. Nonetheless, lead shot remains available in stores in Barrow and other North Slope villages and is still legal for use in hunting upland game such as ptarmigan. Whether through illegal use for waterfowl hunting, or legal use for ptarmigan hunting, use of lead shot could result in distribution of pellets in shallow tundra ponds where eiders could ingest them. If oil field development in the Planning Area were to result in increased access by bird hunters, it may result in an increase in lead-shot pellets in tundra wetlands. It is unknown what effects these possible scenarios would have on eider populations.

IV.E. Potential Effect of Human Activities on Predator Populations

IV.E.1. Known Predators

Potential predators to eiders, eggs, and young in the Planning Area include glaucous gull (*Larus hyperboreus*), common raven (*Corvus corax*), arctic fox (*Alopex lagopus*), red fox (*Vulpes vulpes*), grizzly bear (*Ursus arctos*), and polar bear (*U. maritimus*). Predators are attracted to areas of human activity where they feed on garbage and handouts and use human-made structures for denning, nesting, shelter sites, and hunting perches. Concentrations of predators in an area due to human-created attractants may cause increased mortality to eiders in the area.

IV.E.2. Effects

Foxes and bears are attracted to areas of human activity where they feed on garbage and use human-made structures for denning (Burgess et al., 1993; Eberhardt et al., 1982; Follmann, 1989; Follmann and Hechtel, 1990; Truett, 1993). Foxes are known to prey on adult waterfowl (likely including eiders), eider eggs, and young; thus, increases in predator populations could have an effect on eider nesting success, productivity, and adult survivorship. Grizzly bears prey on waterfowl eggs and have been know to destroy large numbers of nests in areas of colonial nesting waterfowl species. Polar bears are unlikely to affect eider populations, because they are mostly absent from the Planning area during the period when eiders are present.

It generally is accepted that populations of glaucous gulls and common ravens have increased on the North Slope in response to the availability of food found in areas of human activity. Ravens and some raptors have been found nesting on manmade structures in oil fields, including on elevated pipelines, bridges, and wellheads (Ritchie 1991; BLM unpublished data). They also have been detected using remote wellheads for hunting perches (BLM unpublished data). Glaucous gulls and common ravens prey on eider nests and young; thus, increases in predator populations could have an adverse effect on eider nesting success and productivity.

Required operating procedure A-2 would tend to prevent the attraction of predators to food and garbage, and ROP E-9 was written to prevent human-made structures from being used as nesting, denning, or shelter sites for predators. These two ROP's have the potential to greatly reduce the attraction of eider predators to new areas of human activity and, consequently, greatly reduce potential predation on eiders, eggs, and young. At the Alpine Development, Johnson et al. (2003) found that predator numbers remained stable from preconstruction through construction periods. They also found no clear evidence that predation rates by either foxes or avian predators changed during their study. Strict compliance with required operating procedures and the fact that developments will be small and scattered likely will result in, at most, a small increase in the number of predators attracted to new developments. The greatly reduced potential for attracting predators to new developments would lead to considering impacts of predation to eiders at these new developments to be very minor.

IV.F. Disturbance Related to Oil Development and Production

Activities during development and production may result in disturbance of eiders with effects on behavior and distribution of individuals and abundance of local or regional populations in or adjacent to the Planning Area. Disturbance may cause nest abandonment, increased energy expenditures that affect physiological condition and rate of survival or reproduction, or long-term changes in behavior such as abandonment of traditionally-used areas (Calef, DeBock, and Lortie, 1976). Disturbance factors could include human and vehicle/equipment activity on gravel pads and roads, cleanup of off-pad oil spills, routine maintenance of off-pad structures, and aircraft and watercraft activity.

IV.F.1. Gravel Mining and Transport

The development scenario of the Preferred Alternative assumes that gravel mining and transport will occur during winter when eiders are not present. As such, there would be no eider disturbance effects associated with this activity. Habitat loss is discussed in Section IV.C.1.

IV.F.2. Oil Field Construction

The gravel placement for roads, airstrips, and all pads associated with wells, processing facilities, pump stations, camps, staging areas, etc. would occur during winter when eiders are not present and would represent no disturbance effect. Other activity on these pads during summer is discussed in the following sections. Pipelines would have no gravel road associated with them. Pipelines would be constructed in winter when eiders are absent from the Planning Area. The effects of habitat loss beneath gravel pads are discussed in Section IV.C.1.a.

IV.F.2.a. Summer Oil- and Gas-Related Activity on Gravel Pads and Roads

Activities on gravel pads when eiders are present in the Planning Area include humans on foot, aircraft landings and takeoffs, vehicles, heavy equipment, drill rigs, and facility noise. The gravel pads to which this section refers are those used for drilling, processing, human habitation, pump stations, etc. Roads are discussed in the following section, and airstrips are discussed under effects of aircraft. Little is known about the effects of this movement and noise specific to nesting eiders, but there have been several studies involving disturbance of other bird species in Alaska's North Slope oil fields (Woodward-Clyde Consultants, 1985; Hampton and Joyce, 1985; Troy, 1986, 1988; Anderson, 1992; Anderson et al., 1992; Burgess and Rose, 1993; Murphy and Anderson, 1993; ABR, Inc., 2002; Johnson et al., 2003). Although vehicle traffic may occur on more areas of pads and roads, humans on foot generally cause a greater disturbance to birds. Tolerance of disturbence varies among species and individuals, and some level of acclimation to disturbance is possible.

In the studies referenced above, not all potentially disturbing events resulted in a reaction by observed birds. For geese and swans in one study (Murphy and Anderson, 1993), only about 10% of vehicle passes did so. Most responses by birds to activities on gravel pads occurred relatively close to the pads, for example, within 200 meters for geese and swans. Behaviors exhibited as a result of disturbance included brief alert posture (raised head) and, less frequently, walking, running, or (rarely) flying.

Some anecdotal observations of spectacled eiders have been made during these studies, suggesting that they react similarly to the other waterfowl studied. Anderson et al. (1996) observed prenesting pairs of eiders closer to roads than were nesting females. The latter may be more sensitive to disturbance. However, female eiders with broods have been known to cross roads between nesting and broodrearing habitats (TERA, 1995). In combination, these studies suggest that those eiders that do react to disturbances on pads most likely would do so with short-term changes in behavior. This may cause increased energy expenditures among those birds within 200 meters of pads and roads, subsequently affecting physiological condition and rate of survival. It may be more likely, however, to affect reproductive success. Given the low proportion of reactions to disturbance factors shown by other species, the relatively short distances from facilities at which most reactions occurred, and the low probability of eiders occurring within those distances, any resulting decrease in reproductive success probably would be minor from the perspective of eider populations.

Any potential displacement of eiders (i.e., redistribution with respect to facilities prior to the beginning of nesting) as a result of disturbance is discussed in the following. A potentially more serious situation would exist if eiders were to nest near a gravel pad with no human activity in early summer but an inception of activity later in the nesting season. This scenario is possible at staging areas, where there would be no activity until later in summer when barges can arrive. If this occurs before the young leave the nest, and the activity is great enough and the eider sensitive enough to cause a conflict, it could result in nest failure or abandonment. In this case the result would be a decrease in productivity for the local eider population. Given the low probability that eiders will be nesting near enough to one of the few staging areas in the Planning Area, and in the context of natural nest failure rates, this scenario is unlikely to result in population-level effects.

IV.F.2.b. Other Activity on Roads

The effects of subsistence activity that may make use of oil facility roads are discussed elsewhere in this document. It is not expected that any recreational or tourism use of oil field roads will occur in the NW NPR-A and, therefore, would not affect eiders

IV.F.2.c. Aircraft Activity

Except for one study conducted between 1999 and 2001 at the Alpine Development (Johnson et al., 2003), the effects of air traffic on nesting waterfowl in the Arctic have not been studied. Derksen et al. (1992) conducted a study of the short-term effects of aircraft disturbance on molting brant in the Teshekpuk Lake Special Area, but it is unknown if molting eiders respond to aircraft in a manner similar to brant. Spectacled eiders are known to nest and raise young near the Deadhorse airport, indicating that at least some individuals are tolerant of frequent aircraft noise, including that from multiengine aircraft and helicopters (TERA, 1996). Air traffic is associated with, and is likely to be an important source of, disturbance to eiders in all phases of development and production of a roadless oil field.

Although the exact number of flights that would occur in the Planning Area is not known, we believe that using the aircraft traffic figures from the Alpine Development (Johnson et al., 2000, 2001, 2003) is a reasonable proxy for the roadless development being analyzed here. The figures presented here include all fights as recorded by air traffic control at Alpine, including flights for research purposes. During the nest monitoring period (June 11-July 12), in the 1999 construction year at the Alpine Development, a total of 166 fixed-wing takeoffs and landings were recorded (average of 5.2 takeoffs and landings/day) including DC-6, Twin Otter/Caravan and small planes (Johnson et al., 2000). During this same time period, 377 helicopter takeoffs and landings were recorded (average of 11.8 takeoffs and landings/day) (Johnson et al. 2000). The year 2000 also was a construction year at the Alpine Development with well drilling, facilities construction, and major structural modifications on pads being done. Between 1 June and 15 July 2000, there were 1,082 fixed-wing takeoffs and landings (average 24 takeoffs and landings/day) and 910 helicopter takeoffs and landings (average 20.2 takeoffs and landings/day) recorded (Johnson et al., 2001). Aircraft types were similar to those used in the 1999 season except for a C-130 in 2000 (8 takeoffs and landings), which was not used in 1999. During the 2001 study period (1 June-15 July), Johnson et al. (2003) reported at total of 689 fixed-wing takeoffs and landings/day (average of 15.3 takeoffs and landings/day) and 776 helicopter takeoffs and landing/day (average 173 takeoffs and landings/day). Although Alpine was in an operational phase during the 2001 nesting period there still were substantial construction activities occurring, and aircraft traffic was greater than what would be expected during a production-only phase. The BLM is expecting similar levels of aircraft activity during the summer development phases of each of the two anchor developments.

Air traffic figures currently are not available for the Alpine Development during the 2002 and 2003 production years; therefore, based on Conoco-Phillips estimate of necessary flights, BLM is estimating that 4 propeller-driven passenger planes and 5-20 helicopter flights/week would be needed to support the facility during the production phase. Helicopter flights along pipeline route are estimated to occur once/month at minimum. Maintenance of the pipeline would occur during the winter months when eiders are not present.

Studies at the Alpine Development on the Colville River Delta (Johnson et al., 2003) found distributions of most water-associated species (spectacled eiders were not sufficiently abundant, and Steller's eiders were not found in the area, to perform a specific analysis) relative to the airstrip did not show detectable differences when control and impacted areas were compared before and after construction (discussed in USDOI, BLM and MMS, In prep.:Section V.B.9.b(1)(b)2)). Numbers of nests of some species did decline between non-construction and construction years; however, because cooler temperatures coincided with heavy construction activity, it was not possible to show a direct link between nest declines and level of activity. In general, these investigations found waterfowl nest densities lower within 1,000 meters of the airstrip during the period when construction air traffic was high. However, there was no significant difference in average distance of nests from the airstrip. White-fronted goose nests (only this species is sufficiently common to detect population trends), and probably nests of other species, were redistributed relative to the airstrip to nearby comparable habitat during heavy construction.

The BLM, in consultation with FWS, has chosen to use the population density figures of 1.11 observed birds per square kilometer for spectacled eiders and 0.06 observed birds per square kilometer for Steller's eiders. Over much of the Planning Area, the actual density of these species is lower than the presented densities. Given these density figures, it is reasonable to say that small numbers of spectacled eiders, and even smaller numbers of Steller's eiders, are likely to encounter high levels of disturbance due to aircraft noise. However, this statement does not hold true in several situations: (1) if an aircraft landing strip is placed in an area of high eider nesting density (eiders have been known to nest semicolonially so there can be relatively large numbers of individuals nesting in an area); and (2) if areas of high eider densities are directly in line with routes overflow with high frequency (from staging areas to development areas, for example). ROP E-11 requires that aerial surveys, habitat mapping and, possibly, ground-based nest surveys will be conducted by the lessee for at least 3 years prior to development. It is hoped that through this research, staging and development areas can be located in areas of lowest possible eider densities so that the fewest individuals will be impacted. Because there are few areas of high eider density in the Planning Area and surveys to locate eiders and their habitats are required to occur before development, and the results of the Alpine study, it appears that impacts to eiders from the effects of aircraft disturbance may be minor.

IV.F.3. Cleanup of Off-Pad Oil Spills

The number and size of oil spills likely to occur as a result of the Preferred Action, and the possibility of oil spills directly affecting eiders or eider nests, are discussed elsewhere in this document. Although the percent of oil spills that would occur when eiders are present on the North Slope and reach beyond gravel pads to the tundra is low, it is expected to happen. Because oil-spill-response and -cleanup activity is immediate, any eiders near a spill could be affected by these activities. Depending on the distance from eiders and the levels of activities, the impacts on eiders would be the same as described for activities on gravel pads in Section IV.F.2.a. The same responses by eiders would be expected, ranging from slight increases in energy expenditure to nest abandonment. Given all the low-probability events that must occur leading up to it, nest abandonment resulting from cleanup of oil spills likely would be rare.

IV.F.4. Displacement of Eiders from Habitats near Facilities, Roads and Airstrips

The noise and activities associated with oil field facilities potentially could cause eiders to avoid nearby habitats. A study of increased noise at a compressor facility at Prudhoe Bay (Anderson et al., 1992) showed a shift in distribution away from the disturbance by some waterfowl species, including spectacled eiders, but not all species. A processing facility in the Kuparuk Oilfield also caused variable responses by birds (Hampton and Joyce, 1985). Spectacled eider broods in both of these oil fields were found within 200 meters of high-noise facilities (TERA, 1995); therefore, some eiders might be displaced by facilities in the NW NPR-A, but it is likely that most would acclimate to disturbances that are ongoing in the operation of an oil facility. A study of shorebird and passerine distribution before and after construction of a drill pad at Prudhoe Bay (Troy and Carpenter, 1990) suggested that those individuals that were displaced, either by disturbance or the direct removal of nest sites by gravel fill, relocated in nearby, comparable habitats. Johnson et al. (2003) found that although estimated noise exposure at nests increased with aircraft traffic levels and with proximity to the airstrip, that exposure did not have a significant effect in changes in nest distribution among the 3 years of the study. If a disturbance factor is present in breeding habitats, it is likely that eiders would either tolerate it or move a short distance. Given the low density of eiders and subsequent presumed lack of competition for nesting habitats, this type of displacement is unlikely to have adverse impacts on eider populations.

Table 2 shows the maximum numbers of eiders expected to be affected by these types of disturbances and potentially displaced by them. Zones of 200 meters (Swem, 2003, pers. commun.) and 500 meters (Johnson et al., 2003) were selected to define the area for which eider numbers were calculated. Although only within the actual gravel footprint would eider displacement be certain, displacement of all eiders from the entire area defined by the two zones was assumed for purposes of calculating total numbers of individuals displaced. Relatively high estimates of density are used for spectacled (1.11birds/km^2) and Steller's (0.06 birds/km^2) eiders (Martin, Nigro, and Platte, 2003, pers. commun.; Larned et al., 2001; Larned, Stehn and Platte, 2003; Ritchie and King, 2002). These assumptions result in a relatively high estimate of the numbers of eiders potentially displaced from these areas: 6 spectacled and 1 Steller's eider from the footprint alone, 96 spectacled and 6 Steller's eiders from the 200-meter zone, and 239 spectacled and 13 Steller's eiders from the 500-meter zone. Combining the gravel footprint and 500-meter zone would result in a maximum of 245 spectacled and 14 Steller's eiders being disturbed and potentially displaced. In addition to other conservative assumptions addressed earlier in this document, these results assume that no mitigating measures for aerial survey requirements and subsequent eider avoidance will be invoked prior to design approval. This would be counter to the mitigation measures that are part of the Preferred Alternative.

Table 2. Gravel Footprint and Zones of Influence for Production and Effects on Eiders

	Gravel Footprint in Acres (km^2)	**200 Meter Zone of Influence in Acres (km^2)**	**500 Meter Zone of Influence in Acres (km^2)**
Anchor Developments (2 at 100 acres each)	200 (0.8)	1,590(6.4)	3,980 (16.1)
Satellite Developments (6 at 100 acres each)	600 (2.4)	19,100 (77.2)	47,700 (193)
Roadless Pump Station	40 (0.2)	240 (1.0)	600 (2.4)
Gravel Extraction Sites (8 at 35 acres each)	280 (1.1)	n/a	n/a
Staging Area (2)	300 (1.2)	680 (2.8)	1,680 (6.8)
Total Area	1,420 (5.7)	21,610 (87.4)	53,960 (218.3)
Spectacled Eiders Affected at 1.11/ac	6	96	239
Steller's Eiders Affected at 0.06/ac	1	6	13

IV.F.5. Facilities Maintenance

IV.F.5.a. Pipeline Maintenance

The reasonable and foreseeable scenario assumes that scheduled pipeline maintenance would occur during the winter. Because eiders would not be present, this activity would pose no disturbance. Emergency maintenance or repairs still could be done when eiders are present and, although this would be a low-probability event, it would have a potential to adversely affect eiders if it occurred. Whether or not any impact would occur, and what level the impact would be, would depend on whether or not any eiders were present in the habitats involved, what phase of the breeding cycle any nearby eiders were in, the distance between the pipeline activities and eiders, and the nature of the activity. Among the possibilities included in the range of potential impacts are minor, short-term behavioral changes, displacement from the immediate area and subsequent successful breeding elsewhere, or nest abandonment with the loss of breeding opportunity for that season. Because emergency maintenance or repair by nature would be local in extent, it likely would affect a negligible portion of the spectacled or Steller's eider populations.

IV.F.5.b. Tower Maintenance

The reasonable and foreseeable scenario does not include the construction of communication towers elsewhere than on the gravel pads. However, cellular phone towers likely would be constructed within the Planning Area by the local phone company. Construction would occur in winter, and maintenance would likely require an average of one visit every 2 months. With this schedule, a tower could be visited twice during each eider breeding season. A visit probably would involve the presence of a small crew (2-3 persons) for a few hours or less in the immediate vicinity of each tower. Access would be by helicopter. Depending on the timing of the maintenance visit and whether or not any eiders occur within the vicinity, the impacts to eiders could vary from none to accidental destruction of a nest by a helicopter. Any impact to eider populations is likely to be negligible.

IV.F.6.1. Watercraft Activity

During the summer open-water season (mid-July to early October), there could be some marine transportation of equipment and supplies needed for exploration. Barges might be used for transport because of logistic and economic issues associated with moving heavy equipment and materials, either by ice road or rolligon, over the long distances from current infrastructure. Barge traffic generally would be limited to routes in shallow, nearshore, waters between staging areas connected to existing infrastructure (e.g., West Dock or Oliktok Point) and staging areas along the coastline in the Planning Area at Cape Simpson or Barrow. Spectacled and Steller's eiders that are accompanying young, or are staging or migrating in coastal or offshore waters during the staging/migration periods (late June/early July; late August/September), could encounter vessels associated with oil and gas activities in the Planning Area. Barges delivering equipment late in the open-water season may could represent a potential collision hazard for eiders. One such case was documented in March 2001, when three spectacled eiders struck a research vessel in the northern Bering Sea wintering area under predawn light conditions (Lovvorn et al., 2003). The number of barges potentially using the area is so low (assumed up to 20) compared to the open-water area available for eiders, that the potential for collisions from this source are considered to be very low.

If facilities or pipelines are located near rivers, streams, or waterbodies, the potential for contamination of the freshwater and/or marine environment exists. ROP A-4 requires that a comprehensive spill-prevention and response-contingency plan be developed to minimize impacts to fish, wildlife or the environment as a result of fuel, crude oil, and other liquid chemical spills. Part of the prevention and response plan likely would include the use of watercraft to facilitate containment and cleanup of spilled oil. This watercraft would be used not only in a real response situation but also in spill-response training. The BLM expects that watercraft used in spill-response training to be small vessels appropriate for the predominately shallow water present in the Planning Area. Spill-response training would occur annually and is expected to involve only a few vessels and personnel. Watercraft may be used during facility development to install water-collection equipment for providing for the water needs of equipment and personnel at anchor facilities. This watercraft also may be needed on occasion to service/repair any equipment deployed in the freshwater environment. Watercraft would be stored on gravel pads close to deployment areas and would not be in the water unless being deployed for a spill-response drill or an actual oil spill. Due to the short time period that any watercraft would be expected to be in areas where eiders could be found (waterbodies), and the small number of watercraft potentially being deployed, it is reasonable to expect that the effect of watercraft on eiders would be very minor.

IV.G. Mitigating Measures

Implementation of stipulations and required operating procedures (selected and abbreviated from the list of Preferred Alternative stipulations and required operating procedures presented in Table II-03 of the IAP/EIS) could conserve important eider habitats, decreasing the probability of disturbance or displacement of eiders. The two following mitigation measures are specifically directed toward avoiding listed eiders as much as possible with the placement of oil facilities:

- require aerial surveys of breeding pairs in areas proposed for development, and consultation with FWS and BLM concerning the design of structures before approval of any construction if listed eiders are present in such areas (ROP E-11);
- require development of an ecological land classification map for use in siting facilities with the intent of moving the proposed location of facilities, to the extent possible, from habitat types of greater importance for listed eiders to those of lesser importance (ROP E-12).

The following four mitigation measures are directed toward protection of fisheries, lake-dwelling waterbirds, raptor nesting areas, and human subsistence activities. Nonetheless, they may benefit listed eiders if eider habitat occurs within the prescribed setbacks:

- restrict approval for location of permanent oil and gas facilities within 500 feet of fish-bearing waterbodies or within 100 feet of non-fish-bearing waterbodies to those that are likely to cause minimal impacts to wildlife (Stip. E-2);
- prohibit permanent oil and gas facilities within setback zones of ½-1 mile of listed waterways (Stip. K-1);
- prohibit permanent oil and gas facilities within ¼ mile of deepwater lakes with depths greater than 4 meters (Stip. K-2);
- prohibit permanent oil and gas facilities within the boundary of the Kasegaluk Lagoon Special Area.

These three mitigation measures are intended to benefit wildlife and fisheries in general, and so would provide some benefit to listed eiders as well:

- require minimal facility footprint and reduction in air traffic (ROP E-5);
- provide all personnel with information concerning applicable required operating procedures and stipulations and the importance of not disturbing biological resources, habitats, and bird colonies (ROP I-1);
- prohibit oil and gas exploration activity in Elson Lagoon, Dease Inlet and Admiralty Bay from May 15 to October 15; require that facilities minimize impacts to seasonally concentrated wildlife, which may include listed eiders, and that daily activities are conducted to minimize impacts to seasonally concentrated eiders (Stip. K-3).

IV.H. Effects of Abandonment

Abandonment and reclamation of satellite fields likely would coincide with abandonment and reclamation of corresponding anchor development sites. Abandonment operations include removal of all equipment, cutting well casings a minimum of 3 feet below the surface, and plugging wells. Gravel, or gravel/sand pads would not be removed but allowed to bed naturally. Overall, abandonment operations would take many years, as revegetation and environmental monitoring studies continue to document the long-term effects of operations at a particular site. A series of permitting and inspection activities are associated with abandonment procedures (Stipulation G-1). Abandonment activities would occur during winter months, when ice roads could be constructed to allow the removal of equipement. Monitoring abandonment would require periodic revisits to gather information on environmental parameters related to natural bedding and to document success of abandonment actions. Normally, one helicopter with a crew of three would visit the sites annually for the first 5 years, followed by increasing time gaps over the next 10 years. Site visits would include a maximum of 1 day per visit, and one visit/year. It would be expected that effects from abandonment would be negligible, because the pads would have to be in place for nearly 3 decades, and eiders would have relocated to more suitable adjacent habitat.

IV.I. Protection Recommendations

These are addressed in Section V.D.

V. CUMULATIVE EFFECTS ON SPECTACLED AND STELLER'S EIDERS

Cumulative effects are defined in 50 CFR 402.02 (Interagency Cooperation on the Endangered Species Act of 1973, as amended):"…those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation."

Since 1965, approximately 9.7 million acres of North Slope/Beaufort Sea acreage have been leased through 32 State sales, including many combined sales. In the past 10 years, the State has conducted 12 lease sales in this area, leasing approximately 4.5 million acres. The State has conducted annual areawide sales in the Beaufort Sea and on the North Slope since 1995. The State proposed (January 2001) to offer six areawide lease sales over the next 5 years. Each State Beaufort Sea offering will extend from Barrow to the Canadian border, while onshore sales will offer all unleased State lands between the Arctic National Wildlife Refuge and the NPR-A. The most recent sales were held in October 2002.

There currently are 25 producing oil fields on the North Slope with Prudhoe Bay, N. Prudhoe Bay, Kuparuk River, Alpine, Milne Point, and Endicott being the most productive. Alpine, which began producing on the Colville River delta in 2000, is the closest that oil field infrastructure has approached the Planning Area. Current and reasonably foreseeable development is presented in Table IV-13.

V.A. Factors Potentially Affecting Eiders

In 1997, the Alaska-breeding population of Steller's eiders was listed as threatened based on the contraction in the species' breeding range in Alaska and the resulting vulnerability of the remaining breeding population to extirpation. Factors impacting the recovery of the Alaska-breeding population of Steller's eiders are not well understood. Thus, there is a related level of uncertainty of cumulative effects. The Final Steller's Eider Recovery Plan (USDOI, FWS, 2002) notes the following factors may be potential causes of decline and/or may pose potential threats to the population: predation, hunting, ingestion of lead shot in wetlands, changes in the marine environment that could affect Steller's eider's food or other marine resources, and exposure to oil or other contaminants near fish-processing facilities in southwest Alaska. Quakenbush and Suydam (1999) reported that risks to be evaluated by the Steller's eider Recovery Team include those related to increased human settlement, disturbance in molting and wintering areas, vulnerability to oil spills, and predation during the breeding season. In April 2003, the Eider Recovery Team ranked tasks that would allow the prioritization of threats and obstacles to recovery for the Steller's eider. These tasks will be further ranked and prioritized at the fall/winter 2003 meeting of the Eider Recovery Team. Tasks that were ranked as high priority and have relevance to the Planning Area, were those having to do with (1) harvest by subsistence hunters, (2) continued use of lead shot and associated accumulation and persistence in the environment, (3) loss of breeding habitat due to human expansion and off-road vehicle use, (4) changes in predator distribution and abundance at Barrow, and (5) predator control (foxes and ravens).

The Final Spectacled Eider Recovery Plan (USDOI, FWS, 1996) states that "(F)actors known to affect or suspected of affecting Spectacled Eider survival…have been identified" but clarified that their relative importance to the decline and the recovery of the species are unknown. Thus, there also is related uncertainty about cumulative impacts on this species. Factors given as potentially affecting survival of spectacled eiders on the breeding grounds included lead-shot contamination of habitat and related lead-shot ingestion; predation; direct take in harvests; research activity; oilfield and mining development. The FWS (USDOI, FWS, 1996) concluded that: "Threats at sea, both known and potential, represent the greatest source of uncertainty in understanding the Spectacled Eider's decline." Factors given that potentially could be adversely impacting survival at sea included competition for prey (e.g., with other sea ducks, marine mammals, and possibly fishes); contaminant accumulation; harvest by humans away from breeding grounds; diseases and parasites; and fishery-related take due to collisions with vessels, incidental take in nets, and indirect effects of fisheries on prey. In February 2003, the Eider Recovery Team prioritized threats and obstacles to recovery for the spectacled eider. The four highest priority threates that have relevance to the action area are: 1) Use of lead shot and the corresponding lead accumulation and persistence in the environment; 2) Increasing predator numbers possibly due to human waste, decrease in fox trapping effort, use of human structures by predators; 3) Harvest of eiders by subsistence hunters, lack of law enforcement; and, 4) Oiling from offshore development.

Thus, available information indicates that, in addition to routine annual management actions and harvest activities in the Planning Area, factors associated with other past Federal and past and future State projects, as well as actions of nongovernmental entities on the ACP, along migration routes, or on winter ranges that potentially could contribute to current and future cumulative effects on threatened eiders include subsistence and sport harvests (and associated lead contamination of the eider's habitat); predation; wildlife research and survey activities, proposed oil and gas exploration and development in nesting and wintering habitats; commercial fishing; commercial development; environmental contamination; marine shipping; and recreational activities. Some of these projects and activities, including those associated with oil and gas development (e.g., State lease areas in Cook Inlet), affect eiders at latitudes south of the Beaufort Sea and outside the summer breeding season. Several of these activities, individually or in combination, probably affect eider populations as much or more than potential effects of petroleum development and may have contributed importantly to recent declines in these populations. While the level or significance of current impacts from most of the aforementioned factors essentially is unknown, we provide the limited information that is available in the following. As discussed in previous sections, oil exploration and development (and other projects and activities) could result in (1) oil or other toxic pollution effects; (2) additional disturbance during breeding and postbreeding periods; and (3) habitat loss or degradation that would add to cumulative impacts on listed eiders. Disturbance of some individuals as a result of oil and gas operations would be expected to be unavoidable.

V.B. Cumulative Analysis

V.B.1. Effects of Disturbance

V.B.1.a. Aircraft and Vessel Disturbance

Oil and gas developments in the Planning Area are expected to be roadless, i.e., no roads connecting an anchor development and its satellites to any other oil infrastructure or village. This design is likely to require substantial fixed-wing aircraft, helicopter, and occasional barge support during periods when eiders are present. Any oil development in adjacent portions of the NPR-A likely would be similar. Oil exploration and development in State or Federal marine waters offshore of the NPR-A probably would rely more on helicopter and barge traffic and less on fixed-wing flights. Much of the air traffic would occur in winter, when eiders are not present. Offshore development at Northstar required 2,480 aircraft (all types) per winter season extending approximately 30 November-20 April, or about 18 flights per day. Cumulative air traffic activity in the Prudhoe Bay area, Kuparuk River, Point McIntyre, Northstar, and Alpine fields is likely to represent the greatest source of disturbance for eiders from currently developed areas.

Regardless of attempts to mitigate effects by adjusting routes, continued activity at this level to support developing fields and future development on the NPR-A likely would result in some low-altitude flights over nesting, broodrearing, staging, or migrating eiders. This would cause additional energy use by disturbed individuals and possibly the displacement of eiders from the vicinity of routinely used air corridors. The latter would be similar to eider responses observed during low-level aerial bird surveys, when individuals either run or take flight depending on species and circumstances. This could cause displacement of females with broods from preferred foraging areas during broodrearing or displacement of any individuals during preparation for migration. In extreme cases such as a helicopter hovering at very low level over a nest, the female could flush from the nest, resulting in lower productivity if eggs are lost to predators or exposure to low temperatures. Long-term displacement (1 year or more) from the vicinity of heavily used corridors and onshore facilities could result in fewer young produced and somewhat lower survival of adults and young. For example, helicopter pipeline inspection flights during production could displace some eiders from within 200-500 meters of a pipeline. Although such flights might occur frequently, perhaps once per week, they would be intermittent. Some individuals might tolerate this level of disturbance and nest, rear their broods, or forage within the pipeline corridor. Any such aircraft-related disturbance from new developments would represent additive effects over existing levels. However, because of the relatively low density of listed eiders nesting in the NPR-A, disturbance resulting from support aircraft noise and visual presence likely would affect a small percentage of the total populations of spectacled and Steller's eiders breeding in Alaska.

At some unknown level of aircraft overflights above open-water areas in spring, it is possible that some eiders would be displaced from this essential habitat. Because open water is limited in spring, access to such areas is likely to be more restricted than in the postbreeding period. This could increase competition for the food available during the stressful period following spring migration and could result in decreased survival or breeding success. Beginning in early summer, nonbreeding individuals, failed breeders, molting individuals, and males could be feeding in nearshore areas. Displacement during this period could increase the stress of preparing for migration in some individuals and decreasing chances for survival.

Any development offshore of the Planning Area could use the same marine docking facilities assumed in the project description. These would be at Barrow or Cape Simpson. Offshore development also could be staged out of Prudhoe Bay with materials transported by vehicle in winter or barge in summer. If displacement of eiders occurs in the vicinity of vessel transportation corridors, it could last through an entire open-water season. This would depend on trip frequency, which is determined by the number of concurrent projects and the stage of development. Thirteen vessel round trips per summer, from an equipment source area to an NPR-A staging area, are forecast for any one development project during the construction period. Supply vessels are likely to follow established routes, so the actual area disturbed would be limited. The area and, potentially, the numbers of individuals affected would increase if concurrent projects at different locations were to be developed. Vessel traffic occurs during the open-water season and, although numbers of birds displaced could be substantial depending upon the season of occurrence (tens or hundreds of individuals, particularly during fall migration), alternate foraging and staging habitat would be available away from probable routes.

V.B.1.b. Vehicle Disturbance

Besides the reasonable and foreseeable development for the Planning Area discussed elsewhere in this document, there could be up to three other oil field developments within the range of spectacled and Steller's eiders in the Northeast NPR-A. All future oil and gas developments in the NPR-A are expected to be isolated from existing road systems. The effects of vehicle traffic at developments in the Northeast NPR-A would be similar to that for Planning Area described in this document. These additional effects would be additive with respect to North Slope eider populations but not with respect to individual eiders. Each eider on its breeding range would be affected by vehicle traffic at one, or no, development site.

V.B.1.c. Other Disturbance Factors

Disturbance caused by factors other than those discussed above relate to human presence in areas used by eiders due to offshore construction and drilling activities and offshore support of these activities, oil-spill cleanup due to offshore development, hunting in newly accessible areas, and predators attracted to areas of human habitation. These factors vary considerably in the amount of disturbance caused. The presence of unconcealed humans, whether associated with onshore or offshore oil and gas development, hunting, or recreational activities, is disturbing to eiders, especially during nesting and broodrearing periods. Common experience confirms that such presence generally causes birds to move from the immediate area of disturbance and may displace them for several hours or longer. Cumulative effects of such disturbance may cause decreased productivity or survival of young, causing decreased recruitment into the population. The amount of human disturbance that would occur if oil were spilled from an offshore production facility is unknown but, depending on the time of year that the spill occurred, the impact to eiders could range from nonexistent (winter) to very high (if a spill occurred when staging flocks of eiders were present in the marine environment). Predation and hunting by humans may cause direct mortality to eiders. Predators such as foxes attracted to nesting areas could cause losses of eggs or young, ranging up to total nest failure for the season. Most such disturbance associated with commercial activities (excluding oil-spill response) could be controlled by mitigation. Although it is likely that behavioral effects resulting from disturbance associated with oil and gas development would be additive to naturally occurring disturbances, there is no evidence for synergism, in which the combination of effects from natural and/or development-related factors would be greater than their additive effects.

V.B.2. Effects of Habitat Alteration

Potential effects of permanent habitat alteration (habitat loss) in the Planning Area include those effects associated with potential construction projects in villages within the Planning Area in support of offshore oil and gas leasing in State or Federal waters outside the NPR-A. If construction projects in support of offshore oil and gas activities occur in the Barrow Area, there is the potential for impacts to eiders from (1) destruction of eider habitat if new gravel mine sites are necessary to support new construction projects, (2) destruction of eider habitat through placement of gravel fill for construction of roads and structures, and (3) increasing accessibility of areas currently untracked by off-road vehicles and associated damage to eider habitat. The first and second potential impacts have been discussed and analyzed in Section IV.C.1.a of this document. It is unknown if these activities would occur in the Planning Area in response to offshore oil and gas development and, if they do occur, it is unknown at this time the extent of eider habitat that would be impacted. It is reasonable to assume that if these actions do take place near Barrow, Steller's eiders are likely to be impacted, as relatively high concentrations of Steller's eiders occur in the Barrow area. The issues relevant to the third potential effect are (1) potential for loss of habitat due to off-road vehicle use in previously inaccessible areas due to construction activities in the area and (2) contamination of additional eider habitat due to deposition of lead shot in areas previously unavailable to hunters. Contamination of habitat due to introduction of lead shot in the environment is discussed in Section IV.D.2 of this document. Because it is currently unknown if any construction activities will occur in the Planning Area due to offshore oil and gas development, there is no way to quantify potential impacts to eider habitat. If construction activities do occur, consultation with the [illegible] will occur and impacts to eider habitat will be addressed at that time.

There also is potential for impacts to eider habitat due to temporary habitat alteration resulting from the above-stated potential development activities in the Planning Area. These impacts may include delayed snowmelt due to snow dumps from snow-removal activities on pads and roads, dust fallout due to traffic on new roads, persistent snow drifts, impoundments, thermokarst, and water withdrawal to support construction and maintenance of facilities. All of the above impacts are discussed in Section IV.C.1.b of this document. It is unknown if construction activities that would result in temporary habitat alteration would occur in the Planning Area in response to offshore oil and gas development and if they do occur, it is unknown at this time the extent of eider habitat that would be impacted. It is reasonable to assume that if these actions do take place near Barrow, Steller's eiders are likely to be impacted, as relatively high concentrations of Steller's eiders occur in the Barrow area. If construction activities do occur consultation with the USFWS will occur and impacts to eider habitat will be addressed at that time.

V.B.3. Potential Additional Cumulative Effects

Subsistence harvesting is estimated to remove hundreds of spectacled eiders from the Alaskan population annually (58 *FR* 27474). Steller's eiders are also still harvested (USDOI, FWS, 2002c), but the percentage of the harvest that is taken from the Alaska breeding population is not clear. Increased harvest of listed eiders within the Planning Area is discussed in Section IV. Developments in the Northeast NPR-A also may increase the access of hunters to eiders in the area of Nuiqsut, although some residents there have stated that they do not prefer to hunt in the vicinity of oil field developments. Programs currently are underway by the FWS and the North Slope Borough to inform hunters of harvest closures on these two species in an effort to decrease this source of mortality.

There is potential for collisions of eiders with structures and vehicles associated with offshore oil and gas development. These potential collisions include those associated with offshore oil and gas development structures and support services and onshore support facilities for offshore oil and gas development. Structures associated with offshore oil and gas development include offshore platforms, related onshore pipelines, barges, helicopters, and oil-spill-response watercraft. The time of year when offshore activities would have the greatest potential for impacts to eiders would be during the late summer/fall staging period, when relatively large numbers of eiders are found in marine areas. Migration pathways of eiders may include areas where offshore production facilities are constructed, resulting in potential for collisions between eiders and those structures. Eiders could collide with watercraft responding to an oil spill from a pipeline or oil-producing platform. Helicopter flights would be necessary to support offshore platforms, and there is potential for collisions between eiders and helicopters. Offshore facilities also would be supported by barges, which also represent a collision hazard to eiders. Research currently is being conducted to assess the potential for collisions between birds and offshore oil-producing facilities (Northstar development) and to develop methods by which collisions can be reduced. Structures associated with onshore support of offshore oil developments include support facilities; communication and power lines and towers; pipelines; and support watercraft, motor vehicles, and aircraft. The effects of collisions to eiders from these structures are discussed in Section IV of this document and are expected to be similar. If power lines would be needed in support of offshore oil and gas development, they may have greater effects on eiders than those discussed in Section IV, because these may be strung on poles and not on pipeline VSM's. Power lines strung from poles are a known collision hazards to birds and could account for additional mortality to eiders. Because we do not know where or if any offshore oil-producing facilities would be constructed, we cannot assess the potential impacts of these facilities to eiders. If these facilities are built in the future, consultation with FWS would occur and these potential impacts would be addressed.

V.C. Effects of a Large Oil Spill

V.C.1. Marine Habitats

If future oil field development were to occur in State or Federal marine waters offshore of the Planning Area, there would be some low, but positive, probability of a large oil spill. If one or more spill were to occur, substantial eider losses could result if oil were released during the summer/fall season, when flocks of eiders could be present. The number of eiders affected potentially could total tens to low hundreds of individuals. Using average estimated spectacled eider density in the central Beaufort Sea area calculated from FWS survey data, and average severity of spill-trajectory paths (and, thus, exposure of birds to oil), a FWS model estimated an average of only two eiders would be exposed to a large spill (5,912 barrels) within 30 days in July (Stehn and Platte, 2000). However, in late July one group of 144 individuals was observed, suggesting a potential for much higher mortality. Also, most eiders observed during FWS aerial surveys in 2001 from Point Barrow east were located along the northern Planning Area boundary. It is likely that mortality resulting from oil spills would be additive to naturally occurring mortality. In addition to direct contact losses, any declines of prey populations in foraging areas contacted by oil from a spill at any time of year could result in secondary impacts on eiders, affecting productivity and/or survival. Likewise, negative effects of a spill on shoreline and coastal marsh habitat and water quality could affect eiders adversely when moving from onshore broodrearing areas to the marine environment, or in subsequent years.

V.C.2. Terrestrial /Freshwater Habitats

A large onshore spill released during the summer season on lands east of the Planning Area could cause losses of molting and broodrearing eiders, in addition to smaller numbers of nesting eiders, if it were to enter a heavily used lake or river system or coastal habitat. Spills from a regional pipeline farther east would not be expected to cause substantial losses of eiders, because there are relatively low densities so far to the east on the ACP. In the immediate vicinity of the pipeline, some habitat contacted by oil would become unsuitable for nesting, broodrearing, or foraging by eiders. Oil entering freshwater aquatic habitats could spread more widely, including into river deltas and nearshore marine habitats, and result in the death of eiders if contacted.

V.C.3. Effects of Small Spills

Small spills on lands or waters adjacent to the Planning Area, whether from infield pipelines or spills of refined products, are expected to be contained on gravel pads or islands or cleaned up before substantial losses of eiders could occur. In addition to direct contact, some mortality could result through ingestion of contaminants in forage from the cumulative effects of the numerous small spills expected from the operation of any oil field.

V.D. Protection Recommendations

V.D.1. North Slope Science Initiative

A North Slope Science Initiative currently is being developed that will address inventory, monitoring, and research needs across the North Slope, including the National Petroleum Reserve-Alaska. This initiative, with State/Regional Director-level guidance from the BLM, FWS, MMS, U.S. Geological Survey, Alaska Department of Fish and Game, Alaska Department of Natural Resources, and the North Slope Borough, will consider proposals for all scientific initiatives, including those studies related to spectacled and Steller's eiders.

V.D.2. Spectacled and Steller's Eider Recovery Teams

The BLM has representation on both the spectacled and Steller's eider recovery teams. Recommendations for inventory, monitoring, or research, developed by those recovery teams, are expected to be addressed within the North Slope Science Initiative and will be forwarded to the North Slope Management Oversight Group for consideration.

V.D.3. Leasing Stipulations and Required Operating Procedures

Implementation of stipulations and required operating procedures (selected and abbreviated from the list of Preferred Alternative stipulations and required operating procedures presented in Table II-03 of the IAP/EIS) could conserve important eider habitats, decreasing the probability of disturbance or displacement of eiders. The two following mitigation measures are specifically directed toward avoiding listed eiders as much as possible with the placement of oil facilities:

- require aerial surveys of breeding pairs in areas proposed for development, and consultation with FWS and BLM concerning the design of structures before approval of any construction if listed eiders are present in such areas (ROP E-11);
- require development of an ecological land classification map for use in siting facilities with the intent of moving the proposed location of facilities, to the extent possible, from habitat types of greater importance for listed eiders to those of lesser importance (ROP E-12).

The following four mitigation measures are directed toward protection of fisheries, lake-dwelling waterbirds, raptor nesting areas, and human subsistence activities. Nonetheless, they may benefit listed eiders if eider habitat occurs within the prescribed setbacks:

- restrict approval for location of permanent oil and gas facilities within 500 feet of fish-bearing waterbodies or within 100 feet of non-fish-bearing waterbodies to those that are likely to cause minimal impacts to wildlife (Stip. E-2);
- prohibit permanent oil and gas facilities within setback zones of ½-1 mile of listed waterways (Stip. K-1);
- prohibit permanent oil and gas facilities within ¼ mile of deepwater lakes with depths greater than 4 meters (Stip. K-2);
- prohibit permanent oil and gas facilities within the boundary of the Kasegaluk Lagoon Special Area.

These three mitigation measures are intended to benefit wildlife and fisheries in general, and so would provide some benefit to listed eiders as well:

- require minimal facility footprint and reduction in air traffic (ROP E-5);
- provide all personnel with information concerning applicable required operating procedures and stipulations and the importance of not disturbing biological resources, habitats, and bird colonies (ROP I-1);
- prohibit oil and gas exploration activity in Elson Lagoon, Dease Inlet and Admiralty Bay from May 15 to October 15; require that facilities minimize impacts to seasonally concentrated wildlife, which may include listed eiders, and that daily activities are conducted to minimize impacts to seasonally concentrated eiders (Stip. K-3).

V.E. Summary

The cumulative effects on spectacled and Steller's eiders of future developments both onshore and offshore of the Planning Area and on lands to the east likely would be greater than for activities associated with the Preferred Alternative alone. Disturbance of some individual eiders as a result of both onshore and offshore oil and gas operations probably are unavoidable over the long term. The cumulative effects from typical activities associated with exploration and development of oil and gas prospects in the Planning Area, lands to the east, and adjacent marine areas may include small declines in local nesting or loss of small numbers of spectacled eiders, and potentially Steller's eiders, through disturbance effects on survival and productivity, predation pressure enhanced by human activities, and collisions with structures.

Declines in fitness, survival, or production of young could occur where eiders are exposed frequently to various disturbance factors, particularly low-level helicopter traffic. Human presence that would disturb nesting or broodrearing eiders, or attract predators, could result in predation of unprotected eggs or young. Because of smaller disturbed areas, the effects of future project infrastructure on eider populations, although additive to natural effects, would be expected to be less severe than with previous arctic oil field developments. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities. Overlap between cumulative project developments could increase disturbance effects. Spectacled and Steller's eiders, for which no statistically significant population trends are apparent on Alaska's North Slope, could be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect would be expected to result from small losses. However, recovery from any short-term losses associated with oil and gas development could be hindered by lowered survival or productivity resulting from anthropogenic causes elsewhere or natural occurrences anywhere in the species' range.

Onshore spills (large ones considered unlikely) would be expected to be contained and cleaned up; however, a spill entering a lake could cause some loss of broodrearing eiders plus smaller losses of nesting individuals. If a large oil spill were to occur in or reach the marine environment during high-use periods some, and perhaps substantial, mortality of eiders would be possible; any substantial loss of eiders could represent a significant population effect and an important obstacle to full population recovery. Mortality resulting from the cumulative effects of oil and gas projects (oil spills, collisions, or increased predation or hunting) would be additive to natural mortality and would interfere with the recovery of these species' ACP populations.

V.F. Conclusions

Cumulative disturbance and mortality factors, associated with oil and gas and other activities in the Planning Area and surrounding lands and waters, may cause small, local declines in numbers of nesting eiders, or a small decrease in productivity. Spatial and temporal overlap among cumulative project developments could increase these effects, resulting in delayed recovery from threatened status. None of the management or industrial activities discussed are likely to cause significant population effects. However, although the probability of occurrence is low, a large oil spill that reaches marine areas when flocks of eiders are present could result in substantial eider mortality and interfere with recovery of either species.

V.G. Agency Determination

Section 7(a)(2) of the Endangered Species Act of 1973, as amended, requires the action agency to insure any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered, or threatened species, or take an action that would result in the destruction or adverse modification of habitat of such species. The Bureau of Land Management, with respect to reasonably foreseeable development scenario, presented in this document, determines its actions may have an affect on the threatened spectacled and Steller's eiders. Although a small amount of habitat may be disturbed, or modified by the reasonably foreseeable development scenario, the Planning Area has no designated critical habitat.

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Appendix [illegible]

Management Objectives and Standards for Designated Wild and Scenic Rivers

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Appendix 11. Management Objectives and Standards for Designated Wild and Scenic Rivers

The information presented here is largely excerpted from a 2002 technical report titled *Wild & Scenic Rivers Management Responsibilities*, by Jackie Diedrich of the Interagency Wild and Scenic Rivers Coordinating Council.

A. Summary of Wild and Scenic River Management Guidelines

To assess the impacts of wild and scenic river designation in the Planning Area, provisions of the Wild and Scenic Rivers Act (WSRA) should be understood. An interagency interpretation of the WSRA completed in 1982--the Departments of the Interior and Agriculture Interagency Guidelines for Eligibility, Classification and Management of River Areas--provided the basis for the wild and scenic rivers discussion in the previous *Northeast NPR-A IAP/EIS*. Since these guidelines were issued, several sections of the WSRA have been amended to clarify intent. In addition, and as a result of litigation, the courts have provided interpretation of various provisions of the WSRA.

This appendix examines the WSRA with the goal of describing management implications of designation. All Federal Agencies have a legal obligation to protect the free flow, water quality, and outstandingly remarkable values (these characteristics are referred to collectively as "river values") of designated wild and scenic rivers. The outstandingly remarkable values for the eligible rivers are listed in Section III.C.10 of this IAP/EIS. Free flow is defined in the WSRA, and on the last page of this appendix. Mineral leasing and development are allowable in scenic river segments if river values can be protected or if pre-existing rights are involved.

B. WSRA Section 1(b)

The purposes for which a Wild and Scenic River (WSR) is added to the National Wild and Scenic Rivers System (National System) are explicit in section 1(b) of the WSRA--specifically, to protect a river's free-flowing condition, water quality, and outstandingly remarkable values (ORV's). Sections 7(a) and 10(a) of the WSRA refer to these collective "values" for which rivers are added to the National System.

Management Implications

The ORV's for eligible rivers in the Planning Area are listed in Table III-38. If any of these rivers were to be determined to be suitable for recommendation for WSR designation, BLM would focus on protecting the river's free-flowing condition and water quality in addition to its ORV's. The ORV's would be thoroughly refined in comprehensive river management plans, prepared after the Northwest NPR-A Record of Decision (ROD) to guide future management actions and to serve as the baseline for monitoring.

C. WSRA Section 2(b) - Classification

The three WSR classifications for designated rivers are:

> (1) Wild river areas. Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with essentially primitive watersheds or shorelines and unpolluted waters. These areas represent vestiges of primitive America.
>
> (2) Scenic river areas. Rivers or sections of rivers that are free of impoundments, with shorelines or watersheds that are still largely primitive and undeveloped, though they are accessible in places by roads.
>
> (3) Recreational river areas. Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

The classification system describes the type and intensity of development in existence at the date of the river's designation. To be "administered" in a class means defining the river's initial landscape character and establishing standards relative to future in-corridor land uses. For example, administering a wild river would require more restrictive decisions to protect the river's character than would a scenic or recreational river.

The intent of the WSRA to preserve each river's free-flowing condition and to protect and enhance the values for which it was designated applies equally to rivers in each of the three classifications. A river's classification does not represent the values for which it was added to the National System. In the alternatives discussed in this IAP/EIS, BLM has identified the appropriate classification as "scenic" because of the level of development (mainly subsistence cabins and camps), although this does not mean that scenery is an ORV. In fact, none of the eligible rivers in the Planning Area has scenery as an ORV.

Management Implications

On September 19, 2000, in Wilderness Watch v. U.S. Forest Service (D. MT 2000), the U.S. District Court for the District of Montana found "construction of permanent resort lodges in river corridors designated as wild is inconsistent with the Act." This opinion is responsive to a specific set of facts on the Salmon WSR, i.e., the decision of the U.S. Forest Service (USFS) to allow pre-designation hunting camps located on National Forest System lands and within a wild river corridor to be relocated and/or substantially modified under the agency's special-use authority. The new facilities include a complex of permanent structures. The judge remanded the matter to the USFS to determine a remedy consistent with his opinion.

This decision prompted BLM to identify scenic classification as the most appropriate, even though the rivers are generally not accessible in places by road, since existing subsistence uses require the addition, relocation and modification of subsistence camps and cabins.

- The BLM would use the scenic classification to provide a general framework for the type and intensity of land management activities that may take place in the future.
- The BLM would apply the protections under Sections 7 (water resources projects) and 10(a) (no degradation policy)) independent of classification.

D. WSRA Sections 3(b) and 3(c) - Establishment of Boundaries and Classification; Public Availability

Boundaries would be drawn during the development of comprehensive resource management plans for any designated river areas. These upland boundaries would contain a maximum of 640 acres per river mile (acre/mile). This follows the precedent set in ANILCA for Alaskan wild and scenic rivers, rather than the 320-acre/mile limit for rivers outside Alaska. The 640-acre/mile limitation represents an average, and not a mile-by-mile measure.

Management Implications

- A bank-to-bank boundary would not be adequate.
- BLM would use a river's ORV's as the basis for boundary establishment.
- The final WSR boundary is not required to be posted or otherwise located on the ground.

E. WSRA Section 7(a)-Restrictions on Hydroelectric and Water Resources Projects on Designated Rivers

Water resources projects are defined as projects that would affect the free-flowing nature of a WSR and would include dams, diversions, and riprap.

Management Implications

1. Authority

The Secretary of Agriculture or the Secretary of the Interior (or his/her designee) is responsible for making determinations under Section 7. This authority has been delegated to the BLM Field Manager level in each state.

2. BLM Criteria

The BLM would evaluate a water resources project based on its effects on the values for which a river is added to the National System, namely its free-flowing condition, water quality, and ORV's. The river's classification is not a factor in this evaluation.

3. Consideration of Projects

Federal Energy Regulatory Commission-licensed facilities are prohibited within the corridors of designated rivers. Other Federally-assisted water-resources projects proposed to be built within the corridors of a designated river would be evaluated for potential "direct and adverse effect" on the values for which the river was designated. Proposed water resources projects below, above, or on a stream tributary to a designated river are evaluated for their potential to invade the designated river area or unreasonably diminish the scenic, recreational, fish, or wildlife values of the designated river.

F. WSRA Section 9(a)-Limitations on Mineral Entry and Development on Public Lands on Designated Rivers

Management Implications

In areas where mineral activity is permissible, the Comprehensive River Management Plan (CRMP) should address "locatable," "leasable," and "salable" mineral materials. Locatable minerals are defined as "valuable mineral deposits" under the General Mining Law of 1872, as amended, and include, gold, silver, copper, and lead. Leasable minerals are defined by statute (e.g., oil, gas, coal, geothermal); a lease must be obtained from the Government for their extraction. Salable minerals are disposed of by permit and consist of common varieties of sand, stone and gravel. Leasable and salable mineral activities in the Planning Area are at the discretion of BLM.

The WSRA affects the development of minerals on Federal lands in several ways.

- First, subject to valid existing rights (i.e., existing mining claims and mineral leases), the minerals located on Federal lands within the bed or banks or within 1/4 mi of the banks of any designated wild river are withdrawn from all forms of appropriation under the mining laws and from the operation of the mineral leasing laws.
- Second, subject to valid existing rights (i.e., subject to mining claims where the claimant has filed a proper patent application and paid the required fees before the river's designation), mining claimants may only obtain title to the mineral deposits and such rights to the use of the surface and surface resources as are reasonably required for prospecting or mining.
- Third, the WSRA requires that regulations be developed to govern mining and mineral leasing activities in WSR corridors. While the Secretaries of the Interior and Agriculture have not issued these regulations, the BLM and USFS use their existing regulations (43 CFR 3809 and 36 CFR 228, respectively) to meet, to the extent possible, the non-degradation standard of Section 10(a).

G. WSRA Section 10(a) - Management direction

The Interagency Guidelines interpret Section 10(a) as a "non-degradation and enhancement policy for all designated river areas, regardless of classification." Existing uses on Federal lands may continue where they do not conflict with river protection. Adverse effects to the values made explicit in Section 1(b) of the WSRA on Federal and non-Federal lands must be identified in development of the CRMP, with appropriate strategies detailed for their resolution. To achieve a nondegradation standard, the river-administering agency must document baseline resource conditions and monitor changes to these conditions.

Management Implications

This section of the WSRA is interpreted as a nondegradation and enhancement policy for all wild and scenic rivers, regardless of classification. The river manager must seek to protect existing river-related values and, to the greatest extent possible, enhance those values.

- Provide for public recreation and resource uses that do not adversely impact or degrade the values for which the river was designated .
- Protect rivers by documenting and eliminating adverse impacts on values (freeflow, water quality, ORV's), including activities that were occurring on the date of designation. Enhance rivers by seeking opportunities to improve conditions.

H. Section 10(b) - Management of WSR's in Wilderness

Section 10(b) removes the potential for conflict regarding WSR's flowing in designated wilderness by applying the more restrictive provisions of the WSRA in any situation of conflict. Section 10(b) recognizes the importance of designating river systems by removing any potential for conflict in cases of dual designations.

I. WSRA Section 11(b)(1) - Federal Assistance to Others

This section authorizes the Secretary of the Interior, the Secretary of Agriculture, or the head of any Federal Agency to provide both technical (i.e., non-monetary) assistance and the use of Agency funds to States, their political subdivisions, private organizations, and individuals to "plan, protect, and manage river resources." This authority applies to projects/activities on non-Federal lands within and proximate to a WSR corridor. It provides a mechanism to effect partnerships for projects/activities outside designated WSR's, yet with the potential to affect designated WSR values.

Management Implications

During development of a CRMP for a designated river, BLM would identify opportunities for specific written cooperative agreements that could include provision of Federal assistance to other organizations to help in administration of a WSR.

J. WSRA Section 12(a) - Management Policies

Section 12(a). The Secretary of the Interior, the Secretary of Agriculture, and the head of any other Federal department or agency having jurisdiction over any lands which include, border upon, or are adjacent to, any river included within the National Wild and Scenic Rivers System or under consideration for such inclusion, in accordance with section 2(a)(ii), 3(a), or 5(a), shall take such action respecting management policies, regulations, contracts, plans, affecting such lands, following November 10, 1978, as may be necessary to protect such rivers in accordance with the purposes of this Act. Such Secretary or other department or agency head shall, where appropriate, enter into written cooperative agreements with the appropriate State or local official for the planning, administration, and management of Federal lands which are within the boundaries of any rivers for which approval has been granted under section 2(a)(ii). Particular attention shall be given to scheduled timber harvesting, road construction, and similar activities which might be contrary to the purposes of this Act.

Management Implications

- The BLM must consider actions on lands it administers adjacent to any designated WSR's and make certain such actions protect freeflow, water quality, and ORV's.
- Other Federal Agencies must protect these values in actions for which they are responsible within and adjacent to a WSR corridor.

K. WSRA Section 12(b) - Existing Rights

Section 12(b). Nothing in this section shall be construed to abrogate any existing rights, privileges, or contracts affecting Federal lands held by any private party without the consent of said party.

Management Implications

- Existing rights are generally protected.

L. WSRA Section 12(c) - Water Pollution

Section 12(c) directs the river-administering Agency to cooperate with the U.S. Environmental Protection Agency (EPA) and State water-quality agencies in addressing water-quality concerns in WSR's. Cooperation requires active participation by the river-administering Agency in evaluation of existing water quality, identification of limitations, and development of the often long-term strategies necessary to address water-quality-related problems.

Management Implications

- The BLM would seek enforcement of water-quality laws through the EPA and State water-quality agencies.
- The BLM would work in cooperation with the EPA and State-water quality agencies to establish baseline conditions, identify water-quality-related issues, and develop a strategy to improve/protect water quality.

M. WSRA Section 13(a) - Jurisdiction and Responsibilities of State with Respect to Fish and Wildlife

This section clarifies that while the role of the States in management of fish and wildlife is unaffected by the WSRA, the river-administering Agency remains responsible for evaluation of fish or wildlife restoration or enhancement projects that are also water resources projects subject to Section 7(a) of the WSRA. In most instances, such projects would have a beneficial effect on WSR values; however, they must be designed to avoid adverse effects on free flow and other river-related values.

Management Implications

- Develop an effective partnership with State fish and wildlife agencies and local and tribal governments to achieve mutual goals in river protection.

N. Section 13(c) - Federal Reservation of Water

This section expressly reserves the quantity of water necessary to achieve the WSRA's purposes, including protecting the values for which a river is designated.

1. Litigation

The United States entitlement to a Federal reserved water right for rivers designated under the WSRA has been addressed in two recent adjudications, with both finding that the WSRA creates an express reservation of water necessary to achieve the purposes of the WSRA (Memorandum Decision Granting, in Part, and Denying, In Part, the United States" Motion for Summary Judgment on Reserved Water Rights Claims; Idaho District Court, 1998, affirmed Potlatch Corp. v. United States; Idaho Supreme Court, 2000); (In the Matter of the Relative Rights of the Waters of the Klamath River, Order on Motions for Ruling on Legal Issues, and for Summary Disposition, State of Oregon Water Resources Department Hearings Officer Panel, 2001).

Both decisions recognize that preserving the values identified in Section 1(b) of the WSRA are among the purposes for which water was reserved. The decision in the Klamath Basin went on to explain that where Congress has not identified the values to be protected by designation, the task of identifying the designated rivers' ORV's is delegated to the administering agency. The two decisions diverge on the question of how much water to which the United States is entitled. The Idaho courts found that the United States is entitled to the "minimum quantity necessary" to fulfill the purposes of the WSRA, while the Klamath decision held that the United States is entitled to the amount of water "reasonably necessary" to accomplish the purposes of the WSRA.

2. Management Implications

- The BLM would establish baseline conditions, identify water-quantity-related issues, and develop a strategy to protect flow-dependent ORV's for any designated river.
- The BLM would be unlikely to quantify the reservation of water absent significant threats or basin-wide adjudication. This might change if nationwide policy is developed after further legal clarification of the impact of this section.

O. WSRA Section 13(f) - Navigable Rivers

> Section 13(f). Nothing in this Act shall affect existing rights of any State, including the right of access, with respect to the beds of navigable streams, tributaries, or rivers (or segments thereof) located in a national wild, scenic or recreational river area.

Section 13(f) clarifies that nothing in the WSRA affects a State's rights to navigable waterways.

State ownership of the underlying riverbed does not, however, preclude the river-administering Agency from regulating uses (e.g., private and commercial boating) on the water column as necessary to meet the purposes of the WSRA. The need to regulate on-water use includes providing a level of public safety, maintaining a desired recreation experience, and protecting biological and physical values. On-river limitations may include, for example, restrictions on the numbers of private and commercial boaters, timing of use, and type and size of craft.

1. Litigation

See United States v. Lindsey (9th Cir. 1979) and United States v. Hells Canyon Guide Service (9th Cir. 1981).

2. Management Implications

The BLM would work with the State to assure that the State's public trust interest in navigability and the purposes of the WSRA are met.

P. Section 13(g) - Easements and Rights-of-Way

An easement or right-of-way may be granted within the boundary of a WSR, subject to conditions to protect values.

Management Implications

1. The BLM would evaluate any component of a project proposal requiring an easement or right-of-way that is a water resources project under Section 7(a) of the WSRA before further consideration of the easement/right-of-way within a designated WSR area.
2. The BLM would grant an easement or right-of-way subject to the nondegradation policy of Section 10(a) and if it is in accordance with all laws applicable to the area.

Q. WSRA Section 15 - Exceptions for Alaska (Under ANILCA)

Section 15 provides exceptions for rivers added to the National System under the ANILCA. Specifically, the allowable acreage within the boundary is increased and boundaries must exclude lands owned by the State of Alaska or its political subdivisions. The boundary may not surround or effectively surround private land.

R. WSRA Section 16 - Definitions

Section 16. As used in this Act, the term -

(a) "River" means a flowing body of water or estuary or a section, portion, or tributary thereof, including rivers, streams, creeks, runs, kills, rills, and small lakes.

(b) "Free-flowing", as applied to any river or section of a river, means existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence, however, of low dams, diversion works, and other minor structures at the time any river is proposed for inclusion in the national wild and scenic rivers system shall not automatically bar its consideration for such inclusion: Provided, That this shall not be construed to authorize, intend, or encourage future construction of such structures within components of the national wild and scenic rivers system.

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Comparison of the Effectiveness of Stipulations and Required Operating Procedures

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Appendix 12 A. Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C

<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C</th></tr>
<tr><td>**Stipulation A-2 for Alternatives A and B.** Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO, whether in excess of 660 gallons in a single tank or in excess of 1,320 gallons in multiple containers, shall be stored within an impermeable lined and diked area capable of containing 110 percent of the stored volume. The liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment due to overfills and spills. The storage area shall be located at least 100 ft from the active flood plain of any non-fish bearing waterbody and 500 ft from the active floodplain of any fish-bearing waterbody with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes and small equipment.</td><td>**Stipulation A-2 for Alternative C.** Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO, whether in excess of 660 gallons in a single tank or in excess of 1,320 gallons in multiple containers, shall be stored within an impermeable lined and diked area capable of containing 110 percent of the stored volume. The liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. The storage area shall be located at least 500 ft from the active flood plain of any waterbody with the exception of small caches (up to 210 gallons) for motorboats, float planes, and ski planes.</td></tr>
<tr><td colspan="2">The protective measure of Stipulation A-2 does not provide any protective benefit for: **Soils**, **Estuarine Water Quality**, some **Birds**, **Marine Mammals**, **Bowhead Whales**, **Sociocultural Systems**, **Air Quality**, or the **Regional Economy**.

Stipulation A-2 for Alternatives A and B provides essentially the same benefits as provided by Stipulation A-2 for Alternative C for: **Paleontological Resources**, **Freshwater Quality**, **Vegetation**, **Non-Marine and Marine Fish**, **Cultural Resources**, **Recreation**, **Visual Resources**, and **Coastal Zone Resources** by providing protection to resources through spill containment.

Stipulation A-2 for Alternative C provides additional environmental protection above that of Stipulation A-2 for Alternatives A and B for: **Water Resources**, **Terrestrial Mammals**, some **Birds**, **Threatened and Endangered Eiders**, **and Subsistence-Harvest Patterns**. Stipulation A-2 for Alternative C requires containment of fuel, petroleum products, and liquid chemicals, which reduces the likelihood of spills entering a lake or river. It reduces the potential of harming or killing forage fish, which would benefit the breeding success of fish-eating birds such as loons, mergansers, and terns, and threatened and endangered eiders. The protection to subsistence resources is beneficial to the subsistence hunting and gathering.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>**Stipulation A-3 for Alternatives A and B.** Refueling of equipment within 500 ft of the active flood plain of any fish-bearing waterbody and 100 ft from non-fish-bearing waterbodies is prohibited. BLM acknowledges that exceptions are commonly warranted for refueling motor boats, float planes, ski planes, small generators, water pumps and other light equipment used in conjunction with temporary activities.</td><td>**Stipulation A-3 for Alternative C.** Refueling of equipment within 500 ft of the active flood plain of any waterbody is prohibited with the exception of refueling motor boats, float planes, ski planes, small generators, water pumps and other light equipment used in conjunction with temporary activities.</td></tr>
<tr><td colspan="2">The protection offered by Stipulation A-3 does not provide any protective benefit for: **Soils**, **Estuarine Water Quality**, most **Birds**, **Marine Mammals**, **Bowhead Whales**, **Sociocultural Systems**, **Air Quality**, or the **Regional Economy**.

The benefits provided by Stipulation A-3 for Alternatives A and B are essentially the same as the benefit provided by Stipulation A-3 for Alternative C for: **Paleontological Resources**, **Freshwater Quality**, **Vegetation**, **Non-Marine and Marine Fish**, **Cultural Resources**, **Recreation**, **Visual Resources**, and **Coastal Zone Resources** by requiring a 500-ft setback, which affords protection by reducing the likelihood a spill will enter a stream or other waterbody.

Stipulation A-3 for Alternative C provides additional environmental protection above that of Stipulation A-2 for Alternatives A and B for: **Water Resources**, **Terrestrial Mammals**, some **Birds**, **Threatened and Endangered Eiders**, and **Subsistence-Harvest Patterns**. Stipulation A-2 for Alternative C requires a 500-ft setback for all but incidental fuel and chemical storage, which reduces the likelihood of spills entering a lake or river. It reduces the potential of harming or killing forage fish, which would benefit the breeding success of fish-eating birds such as loons, mergansers, and terns, and threatened and endangered eiders. The protection to subsistence resources is beneficial to the subsistence hunting and gathering activities.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>Stipulation B-1 Alternatives A and B. Water withdrawal is not allowed during winter from lakes less than 7 ft (2.1 m) deep unless the waterbody lacks a connection with, and is not subject to, seasonal flooding by a fish-bearing stream. The AO may authorize water withdrawals from any lakes, creeks, or rivers if the proponent demonstrates that the location and volume of water withdrawal does not endanger resident fish populations.</td><td>Stipulation B-1 for Alternative C. Water withdrawal from rivers and streams during winter is prohibited. Water withdrawal is limited to 15% of the under-ice water volume in any fish-bearing lake.
After consultation with the appropriate Federal, State, and NSB regulatory and resource agencies, the AO may authorize withdrawals from any lake if the proponent demonstrates that no fish exist in the lake.
A water-monitoring plan will be required to assess drawdown and water quality changes before, during, and after pumping any fish-bearing lakes.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation B-1 does not provide any protective benefit for: Soils, Vegetation, Marine Fish, Birds, Marine Mammals, Bowhead Whales, Threatened and Endangered Eiders, Recreation, Visual Resources, Environmental Justice, Air Quality, or the Regional Economy.
Both stipulations provide some non-specific benefits to Coastal Zone Resources.
The benefits provided by Stipulation B-1 for Alternatives A and B are essentially the same as the benefit provided by Stipulation B-1 for Alternative C for: Paleontological Resources, Cultural Resources, Water Resources, Freshwater Quality, Terrestrial Mammals, and Coastal Zone Resources by limiting the amount of water that can be withdrawn from lakes during the winter. The requirement to only remove 15% of the under-ice water volume, as required in fish-bearing lakes by ADF&G and ADNR, is lacking in both stipulations.
Stipulation B-1 for Alternative C provides additional environmental protection above that of Stipulation B-1 for Alternatives A and B for: Non-Marine Fish, Subsistence-Harvest Patterns, and Sociocultural Systems. It provides a higher level of protection to the fish and habitat that overwinter in the lakes, which enhances the protection to subsistence activities. Consultation with local regulators (North Slope Borough) is a benefit.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>No corresponding stipulation for Alternatives A and B.</td><td>Stipulation B-2 for Alternative C. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice-road crossings and water pumping stations on lakes.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation B-2 for Alternative C does not provide any protective benefit for: Air Quality, the Regional Economy, Soils, Estuarine Water Quality, Freshwater Quality, Vegetation, Marine Fish, most Birds, Marine Mammals, Terrestrial Mammals, Bowhead Whales, Threatened and Endangered Eiders, Recreation, Visual Resources, Sociocultural Systems, and Environmental Justice.

Both stipulations provide some non-specific benefits for Coastal Zone Resources.

Stipulation B-2 for Alternative C provides some environmental protection for: Paleontological Resources, Water Resources, Non-Marine Fish, some Birds (Loons, Mergansers, and Terns), Cultural Resources, and Subsistence-Harvest Patterns. This stipulation limits snow compaction or removal for all but incidental travel, so the likelihood of increasing freezedown during winter or erosion during summer at a lake or river is greatly reduced. This is in agreement with ADF&G and ADNR. Fish over-wintering areas are better protected with snow in place. Removal of snow allows deeper freezedown of ice and potentially stresses or kills fish. This stipulation could affect the breeding success of fish-eating birds such as loons, mergansers, and terns. The protection of fish resources provides enhanced protection to subsistence-harvest patterns.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr>
<td>ROP C-1 for Alternatives A and B. The following restrictions apply to overland moves, seismic work, and any similar use of heavy equipment (other than actual excavations as part of construction) on non-roaded surfaces during the winter season:
a. Motorized ground-vehicle use will be minimized within one mile of any raptor nest from April 15 through August 15, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use may be prohibited within ½ mile of active raptor nests.
b. Refueling of equipment, when practical, should occur at least 500 ft from fish-bearing waterbodies and 100 ft from other waterbodies.</td>
<td>Stipulation C-2 for Alternative C. The following restrictions apply to overland moves, seismic work, and any similar use of heavy equipment (other than actual excavations as part of construction) on non-roaded surfaces during the winter season:
a. Motorized ground-vehicle use will be minimized within one mile of any raptor nest from April 15 through August 15, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use will be prohibited within 1/2 mile of known raptor-nesting sites.
b. Refueling of equipment is prohibited within the active floodplain of any waterbody.</td>
</tr>
<tr><td colspan="2">The protective measure offered by ROP C-1 for Alternatives A and B and Stipulation C-2 for Alternative C do not provide any protective benefit for: Soils, Estuarine Water Quality, Vegetation, Non-Marine Fish, Marine Fish, Marine Mammals, Bowhead Whales, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality, or the Regional Economy.
Both the ROP and stipulation provide some non-specific benefits for: Coastal Zone Resources.
The benefits provided by ROP C-1 for Alternatives A and B are essentially the same as the benefit provided by Stipulation C-2 for Alternative C for: Paleontological Resources, Freshwater Quality, Terrestrial Mammals, Cultural Resources, and Subsistence-Harvest Patterns.
Stipulation C-2 for Alternative C provides additional environmental protection above that of ROP C-1 for Alternatives A and B for: Water Resources, Non-Marine Fish, Birds, and Threatened and Endangered Eiders. This measure does not allow refueling within the floodplain of rivers and lakes; therefore the likelihood of spills entering a lake or river is reduced for non-fish-bearing waterbodies. This is consistent with agreement between BLM and the ADF&G and ADEC.
Note: ROP C-1g. needs to be reconciled with Stipulation A-3. ROP C-1 could be more restrictive than Stipulation C-2b for fish-bearing waterbodies. The potential for disturbance of raptors, and other birds and threatened eiders occurring within the same area, and hydrocarbon- (etc.-) contamination of waterbirds and threatened eiders over a relatively small proportion of available habitat may be decreased.</td></tr>
</table>

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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>Stipulation D-1 for Alternatives A and B. Exploratory drilling in shallow lakes, streams, lake beds and the active floodplain will only be approved if the applicant can demonstrate to the satisfaction of the AO that impacts to fish, wildlife, vegetation, and the hydrologic condition are minimal.</td><td>Stipulation D-1 for Alternative C. Exploratory drilling in river, stream, and lakebeds, as determined by the active floodplain, is prohibited. In addition, exploratory drilling is not allowed within ¼ mile of any fish-bearing deep lake as determined to be in lake zone III, i.e., depth greater than 4 m (Mellor 1985) as shown in Map 20. If the fish-bearing status of the waterbody is unknown, the burden is on the lessee to demonstrate whether fish are absent.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation D-1 does not provide any protective benefit for: Soils, Estuarine Water Quality, Marine Fish, Birds, Marine Mammals, Bowhead Whales, Threatened and Endangered Eiders, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality, or the Regional Economy.

Both stipulations provide some non-specific benefits for: Coastal Zone Resources.

The benefits provided by Stipulation D-1 for Alternatives A and B are essentially the same as the benefit provided by Stipulation D-1 for Alternative C for: Freshwater Quality and Paleontolugical Resources by reducing the impacts to the resources and lowering the likelihood of an oil spill reaching shallow lakes, streams, and other waterbodies.

Stipulation D-1 for Alternative C provides additional environmental protection above that of Stipulation D-1 for Alternativen A and B for: Freshwater Quality, Vegetation, Non-Marine Fish, Terrestrial Mammals, Marine Mammals, Cultural Resources, and Subsistence-Harvest Patterns. The version of the protective measure in Alternative C provides a higher level of protection for water resources than the protective measure in Alternatives A and B because the Alternative C version requires a setback for exploratory drilling and, therefore, the likelihood of oil spills, drill cuttings, or chemicals entering a lake or river is reduced. This is in agreement with ADF&G and ADEC. There is a higher probability that cultural resources (archaeological sites) will be located near fish-bearing lakes than non-fish bearing lakes. Therefore, prohibiting drilling with ¼ mile of any fish-bearing lakes would serve to protect the cultural resource from impacts from drilling operations. The extended buffer provides a greater degree of protection to fish in the event of a fuel spill or in the event that drilling waste is not reinjected immediately. This measure could potentially prevent spills in or near a river or stream from reaching the marine environment where marine mammals may be exposed to the spill. The additional protection afforded several of the subsistence resources provides a higher the level of protection for subsistence-harvest patterns.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>No corresponding stipulation for Alternatives A and B.</td><td>Stipulation D-2 for Alternative C. Permanent facilities such as airstrips and roads shall not be constructed during the exploration phase of oil and gas development.</td></tr>
<tr><td colspan="2">Stipulation D-2 for Alternative C does not provide any protective benefit for: Soils, Estuarine Water Quality, Freshwater Quality, Bowhead Whales, Recreation, Sociocultural Systems, Environmental Justice, Air Quality, and Regional Economy.
Stipulation D-2 for Alternative C provides environmental protection for: Paleontological Resources, Water Resources, Birds, Terrestrial Mammals, Threatened and Endangered Eiders, Cultural Resources, Visual Resources, Subsistence-Harvest Patterns, and Coastal Zone Resources. The removal of any permanent facilities, such as airstrips or roads constructed for exploratory drilling, is unlikely given the difficulties and cost of removal, should exploration activities not lead to development. Construction of airstrips and roads during the exploration phase would result in having permanent facilities in areas that may never be developed. If not reclaimed, these roads and airstrips would increase recreational access to the area. In turn, this would result in increased harvest of terrestrial mammals and increased disturbance impacts. Cumulative long-term impacts could be significant. The prohibition against constructing permanent facilities during the exploration phase removes the remote changes of disturbing deeply buried paleontological resources and cultural resources, at least during the exploration phase. Structures alter the natural properties of the landscape. Not allowing structures during exploration will ensure that view sheds remain essentially natural, thereby protecting visual resources. This measure would reduce the potential for burial of a relatively small proportion of breeding and foraging habitats used by birds and eiders. Disturbance of birds and eiders would be avoided during the exploration phase of oil and gas development if the roads and airstrips were used during the summer breeding season. The protection afforded to subsistence resources would provide fewer disturbances to subsistence practices.</td></tr>
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No corresponding stipulation for **Alternative A.**	**Stipulation E-1 for Alternative B.** The following subsistence, wildlife habitat, cultural/paleontological and traditional/cultural land use areas (see Map 84) are of significant concern to resource managers and local communities. (Resources of concern are listed in parentheses.) Should significant resources occur within these land use areas based on site specific investigation, additional design features or mitigation developed through site/project specific NEPA analysis will be required to minimize impacts. Setbacks include the bed of waterbodies and are measured from the active floodplain. a. Ikpikpuk River: extending from the mouth south through the raptor nesting area extending from section 13, T7N., R12W. UM, to T2N., R 12W., UM where up to a 1 mile setback may be required (fish, raptors, subsistence, cultural, and paleontological resources). . . . etc. (See Table II-02 for details)	**Stipulation E1 for Alternative C.** Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited within and adjacent to the waterbodies and within the prescribed distances from other resources listed below (see Map 84) at the distances identified to protect fish and raptor habitat, cultural and paleontological resources, and subsistence and other resource values. (Resources of concern are listed in parentheses.) Setbacks include the bed of the waterbody and are measured from the active floodplain. On a case-by-case basis, and in consultation with appropriate Federal, State and NSB regulatory and resource agencies, essential pipeline and road crossings will be permitted through setback areas in those instances where no other suitable sites are available. Stream crossings will be sited perpendicular to the main channel flow; lake crossings will be at the narrowest point. Road crossings will be prohibited in the setback area adjacent to the Colville River a. Ikpikpuk River: a ½-mile setback from the bank of the Ikpikpuk River extending from the mouth south to the Raptor nesting area extending from section 13, T7N., R12W. UM, to T2N., R 12W., UM where a 1 mile setback is required (fish, raptors, subsistence, cultural, and paleontological resources). . . .etc. (See Table II-02 for details)

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The protective measure offered by Stipulation E-1 for Alternatives B and C do not provide any protective benefit for: **Soils, Estuarine Water Quality, Marine Fish, Marine Mammals, Bowhead Whales, Recreation, Visual Resources, Air Quality,** and **Regional Economy**.

Both stipulations provide some non-specific benefits for: **Coastal Zone Resources**.

The benefits provided by Stipulation E-1 for Alternative B are essentially the same as the benefit provided by Stipulation D-1 for Alternative C for: **Birds** and **Threatened and Endangered Eiders**. The potential for disturbance (raptors, other birds, and threatened eiders within the same area), habitat burial (other birds, threatened eiders), hydrocarbon contamination (waterbirds, threatened eiders), and forage fish kill (fish-eating waterbirds such as loons, mergansers, and terns) over a relatively small proportion of available habitat would be decreased.

Stipulation E-1 for Alternative C provides additional environmental protection above that of Stipulation D-1 for Alternative B for: **Paleontological Resources, Water Resources, Freshwater Quality, Vegetation, Non-Marine Fish, Terrestrial Mammals, Cultural Resources, Subsistence-Harvest Patterns, Sociocultural Systems,** and **Environmental Justice.** The setbacks required for permanent facilities from the floodplain of rivers and lakes, the likelihood of spills, thermokarst sediment erosion, or water diversions or impoundments impacting a lake or river are reduced. This is consistent with the agreement between BLM, ADF&G and ADNR. This measure protects channel integrity, bank stability, and riparian vegetation and reduces the likelihood that an oil spill would reach the protected waters. The areas in the setbacks are adjacent to rivers or lakes. This stipulation may confer more protection in riparian habitats that are important use areas for grizzly bears, wolverines and moose. The additional protection would be minor. Paleontological resources and cultural resources are more likely to occur along the banks of waterbodies, especially lakes and rivers. The stipulation of a specified setback from such waterbodies would help to protect these resources. The stipulation also provides greater protection of subsistence resources and traditional hunting and fishing camps; therefore, there would be less disturbance to subsistence activities

<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>No corresponding stipulation for Alternatives A and B.</td><td>Stipulation E-2 for Alternative C. Permanent roads (i.e. gravel, sand) connecting to a road system or docks outside the Planning Area are prohibited. Permanent roads necessary to connect pads within independent, remote oil fields are allowed but they must be designed and constructed to create minimal environmental impacts. Roads connecting production sites between separate oil fields may be considered.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation E-2 does not provide any protective benefit for: Soils, Paleontological Resources, Estuarine Water Quality, Marine Fish, Marine Mammals, Bowhead Whales, Cultural Resources, Recreation, Sociocultural Systems, Environmental Justice, Air Quality, or the Regional Economy.

Stipulation E-2 for Alternative C provides environmental protection for: Water Resources, Freshwater Quality, Vegetation, Non-Marine Fish, Birds, Terrestrial Mammals, Marine Mammals, Threatened and Endangered Eiders, Visual Resources, Subsistence-Harvest Patterns, and Coastal Zone Management. The stipulation prohibits road systems from connecting outside the Planning Area. Thus, the likelihood of a long road that crosses numerous floodplains, rivers and lakes, causing thermokarst sediment erosion, water diversions, or impoundments, is reduced. The prohibition of permanent roads connecting to a road system or docks outside the Planning Area would be beneficial to caribou as they are sensitive to roads and traffic. Having a permanent road crossing caribou habitat would disrupt caribou movements yearlong and if situated in TLH insect-relief habitat (Map 91) the road could disrupt movements of caribou to and from insect-relief areas, potentially resulting in changes in productivity of the herd. Stipulation E-2 also states that permanent roads connecting production sites between separate oil fields may be considered. In general, construction of permanent roads has a negative impact on terrestrial mammals, especially caribou. Depending upon the location of the fields and the length of the permanent road, caribou movements may be disrupted. The potential for impact would be the greatest in the TLH Insect-relief Area (Map 91). The stipulation limits potential impacts to fish habitat from gravel extraction, disruption of natural water flow and drainage, and erosion. It could possibly reduce disturbance of polar bears that may den inland from the coast. Long-term structures alter the natural properties of the landscape and prohibiting long-term development outside the Planning Area will help retain the essentially natural viewsheds. This stipulation reduces the potential for burial of a relatively small proportion of breeding and foraging habitats, and reduces the potential disturbance from vehicles that may use the roads during the breeding season.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (Continued)</th></tr>
<tr><td>ROP E-5 Alternatives A and B. Pipelines and roads shall be designed to facilitate caribou and subsistence user passage.</td><td>ROP E-5 for Alternative C. Above-ground pipelines shall be elevated at least 5 ft, as measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage and subsistence passage and access.

Lessees shall separate elevated pipelines from roads by a minimum of 500 ft, if feasible. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipe and road converge on a drill pad.</td></tr>
<tr><td colspan="2">The protective measure offered by ROP E-5 does not provide any protective benefit for: Soils, Paleontological Resources, Estuarine Water Quality, Freshwater Quality, Vegetation, Non-Marine Fish, Marine Fish, Birds, Marine Mammals, Bowhead Whales, Threatened and Endangered Eiders, Cultural Resources, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality, or the Regional Economy

Both versions of ROP E-5 provide some non-specific benefits for: Coastal Zone Resources.

ROP E-5 for Alternative C provides additional environmental protection above that of Stipulation D-1 for Alternatives A and B for: Terrestrial Mammals and Subsistence-Harvest Patterns.

While moose easily cross under the TAPS, they seem to prefer pipelines that are elevated more than 5 ft. Caribou need pipelines that are elevated at least 5 ft above ground. Elevating pipelines less than 5 ft could facilitate movement by caribou but not to the fullest extent. Extensive data exist that 5 ft is the minimum and this standard should be used. Separating roads and pipelines also facilitates caribou crossing. The greater protection for caribou would result in fewer disturbances to subsistence activities.</td></tr>
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ROP E-6 for Alternatives A and B. Permanent oil and gas facilities upon or within 500 ft of shallow lakes, streams, lake beds, estuaries, and their active floodplain will only be approved if the applicant can demonstrate to the satisfaction of the AO that adverse impacts to fish, wildlife, vegetation, and the hydrologic condition are minimal. Essential pipeline and road crossings will be permitted on a case-by-case basis.	**Stipulation E-3 for Alternative C.** For those waterbodies not listed in stipulation E-1, permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibitnd upon or within 500 ft as measured from the active floodplain. Essential pipeline and road crossings will be permitted on a case-by-case basis.

The protective measure offered by ROP E-6 for Alternatives A and B and Stipulation E-3 for Alternative C do not provide any protective benefit for: **Soils, Vegetation, Marine Fish, Marine Mammals, Bowhead Whales, Cultural Resources, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality**, or the **Regional Economy**.

Both ROP E-6 and Stipulation E-6 provide some non-specific benefits for: **Coastal Zone Resources**.

The benefits provided by ROP E-6 for Alternatives A and B are essentially the same as the benefis provided by Stipulation E-3 for Alternative C for: **Paleontological Rsesources** and **Marine Fish** by protecting and reducing impacts in the floodplains and riparian zones.

Stipulation E-3 for Alternative C provides additional environmental protection above that of ROP E-6 for Alternatives A and B for: **Water Resources, Estuarine Water Quality, Freshwater Quality, Non-Marine Fish, Birds, Terrestrial Mammals, Threatened and Endangered Eiders**, and **Subsistence-Harvest Patterns**. The required setback for permanent facilities from the floodplain of rivers and lakes reduces the likelihood of spills, thermokarst sediment erosion, water diversions, or impoundments impacting a lake or river. This is in agreement with ADF&G and ADEC requirements. The stipulation is slightly more protective of terrestrial mammal habitat in that it strictly prohibits permanent facilities within 500 ft of the active floodplain reducing loss and degradation of riparian habitats. The definite setback lessens the potential for impacts to water quality, fish habitat, and fish by protecting channel integrity, bank stability, and riparian vegetation. Any oil spills are less likely to reach the water. The setback of permanent oil and gas facilities from estuaries would reduce the likelihood of contaminants reaching the estuaries. Since the marine fish often use these estuaries as nursery and feeding areas, these mitigating measures would reduce the amount of disturbance and potential contamination in the near shore marine waters. It lessens the effects to raptors, other birds and threatened eiders within the surrounding area by reducing the potential for burial (loss) of a relatively small proportion of available breeding and foraging habitats, disturbance if roads and airstrips are used during the breeding season, hydrocarbon contamination in case of pipeline lesks, and forage fish kill, would be avoided. It lessens disturbances to subsistence activities by providing greater protection of subsistence resources and traditional hunting and fishing camps.

<table>
<tr><td>ROP E-7 for Alternatives A and B. Gravel mine site reclamation will be in accordance with a plan approved by the AO.</td><td>Stipulation E-4 for Alternative C. Gravel mine sites are prohibited within the active floodplain of a river, stream, or lake. Gravel mine site reclamation will be in accordance with a plan approved by the AO.</td></tr>
<tr><td colspan="2">The protective measure offered by ROP E-7 for Alternatives A and B and Stipulation E-4 for Alternative C do not provide any protective benefit for: Estuarine Water Quality, Vegetation, Non-Marine Fish, Marine Fish, Birds, Marine Mammals, Bowhead Whales, Cultural Resources, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality, or the Regional Economy.
Both ROP E-7 and stipulation E-4 provide some non-specific benefits for: Coastal Zone Resources.
The benefits provided by ROP E-7 for Alternatives A and B are essentially the same as the benefit provided by Stipulation E-4 for Alternative C for: Soils, Freshwater Quality, and Subsistence Harvest Patterns by reducing potential impacts from mining operations.
Stipulation E-4 for Alternative C provides additional environmental protection above that of ROP E-7 for Alternatives A and B for: Paleontological Resources, Water Resources, Birds, Terrestrial Mammals, Threatened and Endangered Eiders, Cultural Resources, Recreation, Visual Resources, Subsistence-Harvest Patterns, Sociocultural Systems, and Environmental Justice. The stipulation requires setbacks for gravel mine sites from the floodplain of rivers and lakes; the likelihood of thermokarst sediment erosion, water diversions, or impoundments impacting a lake or river is greatly reduced. This is in agreement with ADF&G and ADNR regulations. This measure would prevent loss and degradation of riparian habitat that is important to grizzly bears, moose and wolverine. Reclamation of gravel mine sites does not ensure that the original habitat will be restored, resulting in a net loss of this type of habitat. Paleontological resources and cultural resources are more likely to occur along the banks of waterbodies, especially lakes and rivers, the stipulation prohibiting gravel mine sites from the active floodplain of such waterbodies this stipulation would help to protect these resources. People floating rivers in a Semi-Primitive Motorized area expect a certain level of opportunity. This stipulation reduces the likelihood of having a gravel mine within viewshed or within the river area. The stipulation helps reduce long-term disturbances of natural vegetation and the alternation of natural properties of the landscape. The potential for burial (loss) of a relatively small proportion of available breeding and foraging habitats, disturbance if roads and airstrips were used during the breeding season, hydrocarbon contamination in case of pipeline leaks, and forage fish kill, would be avoided.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>**ROP E-8 for Alternatives A and B.** Coastal facilities shall be designed, sited, and constructed to prevent significant changes to near shore oceanographic circulation patterns and water-quality characteristics (e.g., salinity, temperature, suspended sediments) that result in measurements exceeding water-quality criteria, and must maintain free passage of marine and anadromous fish.</td><td>Stipulation E-5 for Alternative C. Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas, except as provided in the paragraphs below. Approved causeways, docks, artificial gravel islands, and bottom-founded structures, shall be designed, sited, and constructed to prevent significant changes to near shore oceanographic circulation patterns and water-quality characteristics (e.g., salinity, temperature, suspended sediments) that result in measurements exceeding water-quality criteria, and must maintain free passage of marine and anadromous fish.
A monitoring program will be required to address the objectives of water quality and free passage of fish. Additional mitigation shall be required where significant deviation from these objectives occurs.</td></tr>
<tr><td colspan="2">The protective measure offered by ROP E-8 for Alternative A and B and Stipulation E-5 for Alternative C does not provide any protective benefit for: **Soils, Vegetation**, most **Birds, Marine Mammals, Bowhead Whales, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality,** and the **Regional Economy**.
Both ROP E-8 and Stipulation E-5 provide some non-specific benefits for: **Coastal Zone Resources**.
The benefits provided by ROP E-8 for Alternatives A and B are essentially the same as the benefits provided by Stipulation E-5 for Alternative C for: **Paleontological Resources, Marine Fish, Terrestrial Mammals**, and **Cultural Resources**. This mitigation would likely benefit migratory fish like the Arctic cisco, since they migrate annually along the coast in the nearshore waters. It would benefit non-migratory marine fish to a lesser degree, since they are not as dependent upon nearshore habitat, where oil and gas facilities may be placed.
Stipulation E-5 for Alternative C provides additional environmental protection above that of ROP E-8 for Alternatives A and B for: **Water Resources, Non-Marine Fish**, some **Birds, Threatened and Endangered Eiders**, and **Subsistence-Harvest Patterns**. This measure prohibits causeways and permanent facilities from rivers and deltas; the likelihood of spills, thermokarst sediment erosion, or water diversions or impoundments impacting a river is greatly reduced. This is consistent with ADF&G and ADNR agreements. A monitoring program would enable the AO to verify whether significant changes to circulation patterns and water quality are occurring. Mitigation to protect fish could then be incorporated if necessary. The potential for burial (loss) of, and disturbance in, a relatively small proportion of available waterfowl and threatened eider foraging habitat would be avoided. This measure provides greater protection of subsistence resources (marine fish) because of fewer disturbances to subsistence activities.</td></tr>
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<table>
<tr><th colspan="2">Comparison of the Effectiveness of Stipulations and Required Operating Procedures for Alternatives A, B, and C (continued)</th></tr>
<tr><td>ROP F-1 for Alternatives A and B. All aircraft use shall be conducted in a manner that will minimize impacts to wildlife and birds.</td><td>ROP F-1 for Alternative C. Aircraft shall maintain an altitude of at least 1,500 ft above ground level (AGL) when within 1/2 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 1/2 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from BLM necessary to plan flight routes when flights may go near falcon nests.

Stipulation F-1. Aircraft shall maintain an altitude of at least 1,000 ft AGL (except for takeoffs and landings) over caribou winter ranges from October 1 through May 15.

Stipulation F-2. Aircraft shall maintain an altitude of at least 2,000 ft AGL over the caribou insect-relief area from June 20 through July 31, unless doing so would endanger human life or violate safe flying practices</td></tr>
<tr><td colspan="2">The protective measure offered by ROP F-1, Stipulation F-1, and Stipulation F-2 does not provide any protective benefit for: Soils, Paleontological Resources, Water Resources, Estuarine Water Quality, Freshwater Quality, Vegetation, Non-Marine Fish, Marine Fish, Marine Mammals, Bowhead Whales, Cultural Resources, Recreation, Visual Resources, Sociocultural Systems, Environmental Justice, Air Quality, and the Regional Economy.

ROP F-1 and both stipulations provide some non-specific benefits for: Coastal Zone Resources.

ROP F-1, Stipulation F-1, and Stipulation F-2 for Alternative C provide additional environmental protections above that of ROP F-1 for Alternatives A and B for: Birds, Terrestrial Mammals, Threatened and Endangered Eiders, and Subsistence-Harvest Patterns. Stipulations F-1 and F-2 have specific requirements that will result in fewer disturbance impacts to terrestrial mammals from aircraft use. The potential for aircraft disturbance of raptors and other bird species and threatened eiders within the specified areas (representing for most species, other than raptors, a relatively small proportion of available nesting and foraging habitat) would be decreased. Stipulation F-1 applies only to ptarmigan, ravens, or other species present in winter. The greater protection of subsistence resources (caribou) would result in fewer disturbances to subsistence caribou hunt.</td></tr>
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<tr><td>Stipulation J-1 for Alternatives A and B. If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate them as distant from raptor nests as practical and feasible, but consistent with the following: alteration of limited, high quality habitat that could significantly reduce prey availability shall be minimized. Of particular concern are ponds, lakes, wetlands, and riparian habitats.</td><td>Stipulation J-1 for Alternative C. If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate them as distant from raptor nests as feasible, but consistent with the following: Within 15 miles of nest sites, alteration of limited, high quality habitat that could significantly reduce prey availability shall be prohibited. Of particular concern are ponds, lakes, wetlands and riparian habitats.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation J-1 does not provide any protective benefit for: Soils, Paleontological Resources, Estuarine Water Quality, Vegetation, Non-Marine Fish, Marine Fish, Terrestrial Mammals, Marine Mammals, Bowhead Whales, Cultural Resources, Recreation, Visual Resources, Subsistence-Harvest Patterns, Sociocultural Systems, Environmental Justice, Air Quality, and the Regional Economy.
Both stipulations provide some non-specific benefits for: Coastal Zone Resources.
Stipulation J-1 for Alternative C provides additional environmental protection above that of Stipulation J-1 for Alternatives A and B for: Water Resources, Freshwater Quality, Birds, and Threatened and Endangered Eiders. With the setbacks for permanent facilities from the wetland areas, rivers, and lakes, the likelihood of spills, thermokarst sediment erosion, or water diversions or impoundments impacting a lake or river is reduced. This is consistent with agreements with ADF&G and ADNR. The potential for burial (loss) or destruction of raptor high quality foraging habitat and breeding and foraging habitats for other bird species and threatened eiders (representing for species other than raptors a relatively small proportion of available habitat) is decreased.</td></tr>
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<tr><th colspan="2">[illegible]</th></tr>
<tr><td>No corresponding stipulation for Alternatives A and B.</td><td>Stipulation J-2 for Alternative C. Petroleum exploration and production activities are prohibited within 1/2 mile of occupied grizzly bear dens, identified by the ADF&G, unless alternative mitigation measures are approved by the AO in consultation with appropriate Federal, State, and NSB regulatory and resource agencies.</td></tr>
<tr><td colspan="2">The protective measure offered by Stipulation J-2 for Alternative C does not provide any protective benefit for: Soils, Paleontological Resources, Water Resources, Estuarine Water Quality, Freshwater Quality, Vegetation, Non-Marine Fish, Marine Fish, Birds, Marine Mammals, Bowhead Whales, Threatened and Endangered Eiders, Cultural Resources, Recreation, Visual Resources, Subsistence-Harvest Patterns, Sociocultural Systems, Environmental Justice, Air Quality, and the Regional Economy.

Stipulation J-2 for Alternative C provides environmental protection for: Terrestrial Mammals (Grizzly Bears) and Coastal Zone Management. For this mitigation measure to be effective, it is necessary to know the location of occupied bear dens. However, if the effort were made to locate bear dens, it would reduce the potential for disturbance of hibernating bears and resultant abandonment of dens and young. In areas of higher bear densities, it could provide substantial protection for bears.</td></tr>
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Appendix 12 B. Effectiveness of Stipulations and Required Operating Procedures for the Preferred Alternative

A. Waste Prevention, Handling, Disposal, Spills, and Public Safety
A-1 Required Operating Procedure
Objective: To protect the health and safety of oil field workers and the general public by avoiding the disposal of solid waste and garbage near areas of human activity. **Requirement/Standard:** Areas of operation shall be left clean of all debris.
A-1 Effectiveness
A-1 would limit the impacts on **wild and scenic river** values by limiting reductions in water quality, reductions in critical flows, obstruction to fish passage, loss of critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. A-1 would protect **water resources and water quality** by reducing the potential for solid waste and garbage to contaminate surface waters. A-1 would reduce the potential effects of human refuse on grizzly bears, arctic foxes, and other **terrestrial mammals.** A-1 is expected to reduce potential **marine pollution** and effects on **marine mammals and fish** in the Dease Inlet/Admiralty Bay area where oil exploration and development may occur under the Preferred Alternative and prevent the attraction of polar bears to camp sites that could result in the taking of polar bears in human/bear interactions. A-1 would help protect the area's **recreation/wilderness** resources as well as the users. A-1 would provide increased protection for terrestrial mammals, thus reducing the potential for impacts on **subsistence-harvest patterns.**
A-2 Required Operating Procedure
Objective: To minimize impacts on the environment from non-hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil field workers and the general public. Avoid human-caused changes in predator populations. **Requirement/Standard:** Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development including seismic activities. The plan shall be submitted to the AO for approval, in consultation with Federal, State and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. The plan shall consider and take into account the following requirements: **a) Methods to avoid attracting wildlife to food and garbage:** All feasible precautions shall be taken to avoid attracting wildlife to food and garbage. (A current list of approved precautions, specific to type of permitted use, can be obtained from the AO.) **b) Disposal of putrescible waste:** Current requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the AO. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with U.S. Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) regulations and procedures. The burial of human waste is prohibited except as authorized by the AO.

A-2 Required Operating Procedure (continued)

c) Disposal of pumpable waste products: Except as specifically provided, BLM currently requires all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, ADEC, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage as approved by ADEC will be allowed as necessary to facilitate annular injection and/or backhaul operations.

d) Disposal of wastewater and domestic wastewater: BLM currently prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by the National Pollution Discharge Elimination System (NPDES) or State permit.

A-2 Effectiveness

A-2 would lessen impacts on some **birds** by preventing artificial enhancement or concentration of bird predators by controlling availability of food and garbage; also, pollution of waterbodies by disposal of waste materials, which could cause toxic reactions in waterbirds or their prey, is prohibited.

A-2 (a, b) would help protect the area's **recreation/wilderness** resources as well as the users.

A-2 would provide increased protection for terrestrial mammals thus lessening impacts to **subsistence harvest patterns**.

A-2 would limit the impacts on **wild and scenic rivers** values by limiting reductions in water quality, loss of critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

A-2 would protect **water resources and water quality** by regulating garbage, wastewater, and drilling wastes.

A-2c would reduce the impacts to **vegetation** by reducing the probability of pumpable waste products reaching the tundra or spreading further once they reach the tundra.

A-2 could lessen impacts to **endangered and threatened species** by preventing artificial enhancement or concentration of eider predators by controlling availability of food and garbage; also, pollution of waterbodies by disposal of waste materials, which could cause toxic reactions in eiders or their prey, is prohibited.

A-2 would reduce the potential effects of human refuse on grizzly bears, arctic foxes, and other **terrestrial mammals**.

A-2 would reduce the likelihood of liquid waste and human refuse from contaminating environments inhabited by **marine fishes**.

A-3 Required Operating Procedure

Objective: To minimize pollution through effective hazardous-materials contingency planning

Requirement/Standard: For oil- and gas-related activities, a Hazardous-Materials Emergency-Contingency Plan shall be prepared and implemented before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Procedures applicable to fuel and hazardous substances handling (associated with transportation vehicles) may consist of Best Management Practices if approved by the AO. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of Federal, State, and NSB contacts. Other Federal and State regulations may apply and require additional planning requirements. All staff shall be instructed regarding these procedures.

[illegible]

A-3 Effectiveness

A-3 could reduce contamination risk to **birds** from accidental spills of fuel or other hazardous substances by preventing their entry into waterbodies and wetlands through implementation of a Hazardous-Materials Emergency-Contingency Plan.

A-3 would reduce potential impacts to **subsistence-harvest patterns** by assuring prompt response to spills thus minimizing impacts to **birds, marine mammals, fish** and fish habitat resulting from fuel use, handling, and storage of fuels and hazardous materials.

A-3 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we expect greater impacts from spills, resulting reductions in water quality, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

A-3 would protect **water resources and water quality** by addressing fuel and chemical storage, fuel handling, spill prevention and cleanup plans.

A-3 would reduce the acreage of impacts to **vegetation** by reducing the probability of oil spills reaching the tundra or spreading further if they reach the tundra and it would reduce the level of impacts by providing for better clean-up of spills.

A-3 would help to prevent large fuel or crude oil spills, and consequently reduce the small potential for impacts to **paleontological and cultural resources** from spill clean-up.

A-3 could lessen impacts to **endangered and threatened species** by reducing contamination risk to eiders from accidental spills of fuel or other hazardous substances by preventing entry of these substances into waterbodies and wetlands through implementation of a Hazardous-Materials Emergency-Contingency Plan.

A-3 would provide increased protection to **freshwater fish** and fish habitat during fuel use, handling, and storage.

A-3 would reduce the potential for introducing fuel spills into environments inhabited by **marine fishes**. Because accidental spills occur, the preparation for and response thereto has the potential to greatly mitigate the magnitude of potentially adverse effects of hydrocarbon spills on marine fishes. This may reduce the number of individual fishes impacted by a spill and the intensity of lethal and sub lethal exposure.

A-3 would reduce the potential effects of spills on grizzly bears, arctic foxes, and other **terrestrial mammals.**

A-4 Required Operating Procedure

Objective: To minimize the impact of contaminants on fish, wildlife and the environment, including wetlands, marshes and marine waters, as a result of fuel, crude oil and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety.

Requirement/Standard: Before initiating any oil and gas or related activity or operation, including field research/surveys and/or seismic operations, lessees/permittees shall develop a comprehensive spill prevention and response contingency plan per 40 CFR 112 (OPA). The plan shall consider and take into account the following requirements:

a) On-site clean-up materials. Sufficient oil-spill-cleanup materials (absorbents, containment devices, etc.) shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment.

b) Storage Containers. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO in excess of 1,320 gallons in storage capacity shall be stored within an impermeable lined and diked area or within approved alternate storage containers such as over packs, capable of containing 110 percent of the stored volume.

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c) Liner Materials. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. **d) Permanent Fueling Stations.** Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. **e) Proper Identification of Containers**. All fuel containers, including barrels and propane tanks, shall be marked with the responsible party's name, product type, and year filled or purchased. **f) Notice of Reportable Spills**. Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the AO as soon as possible, but no later than 24 hours after occurrence.
A-4 Effectiveness
A-4 could reduce contamination risk to **birds** from accidental spills of fuel or liquid chemicals during oil and gas activities by preventing their entry into waterbodies and wetlands through implementation of a comprehensive spill prevention and response contingency plan which includes specifications on cleanup, materials, storage containers, and liner materials. A-4 b, c, and d would greatly increase the protection of **wilderness and recreation resources**. This ROP would help reduce, if not eliminate, fuel spills in pristine areas. This ROP would not unduly restrict recreationists from using the area's resources. A-4 would reduce impacts on **subsistence-harvest patterns** by reducing the potential for impacts on birds, terrestrial mammals, fish and fish habitat, and marine mammals during fuel use, handling, and storage. A-4 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we would expect greater impacts from spills, reductions in water quality, loss of critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. A-4 would protect **water resources and water quality** by regulating fuel and chemical storage, fuel handling; spill prevention and cleanup plans. A-4a-e would reduce the acreage of impacts to **vegetation** by reducing the probability of oil spills reaching the tundra or spreading further if they reach the tundra and would reduce the level of impacts to vegetation, if not the areal extent of impacts, by providing better clean-up of spills. A-4 b, c, d, and f would help to prevent large fuel or crude oil spills, and consequently reduce the small potential for impacts to **paleontological and cultural resources** from spill cleanup. A-4 could reduce impacts to **endangered and threatened species** by preventing entry of fuel or liquid chemicals into waterbodies and wetlands thus reducing contamination risk to eiders from accidental spills of these substances during oil and gas activities. A-4 would provide increased protection to **fish and fish habitat** during fuel use, handling and storage. A-4 would reduce the potential for introducing fuel and oil spills into environments inhabited by **marine fishes**. Because accidental spills occur, the preparation for, and response thereof, has the potential to greatly mitigate the magnitude of potentially adverse effects of hydrocarbon spills on marine fishes. Hence, this ROP may reduce the number of individual fishes impacted by a spill and the intensity of lethal and sub lethal exposure. A-4 would reduce the potential effects of spills and human refuse on grizzly bears, arctic foxes, and other **terrestrial mammals**.

Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)
A-5 Required Operating Procedure
Objective: To minimize the impact of contaminants from refueling operations on fish, wildlife and the environment. **Requirement/Standard:** Refueling of equipment within 500 ft of the active flood plain of any fish-bearing water body and 100 ft from non-fish-bearing water bodies is prohibited. Small caches (up to 210 gallons) for motorboats float planes, ski planes, and small equipment, e.g. portable generators and water pumps, will be permitted. The AO may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.
A-5 Effectiveness
A-5 could reduce the potential impacts to **birds** by prohibiting the refueling of equipment within 500 ft of the active floodplain of fish-bearing and 100 ft of the active floodplain of non-fish-bearing water bodies thus preventing spilled fuel from entering water bodies where fish prey of fish-eating birds (e.g., loons, mergansers, terns) or individual water birds could become contaminated and die (adversely affecting the breeding success of these water bird species). A-5 would greatly increase the protection of **wilderness and recreation** resources and benefit the recreation/wilderness resources and users of the area. This ROP would help reduce, if not eliminate, the possibilities of larger fuel spills in pristine areas, or areas that can ill afford any type of fuel spill. This ROP would not unduly restrict recreationists. A-5 would reduce impacts on **subsistence-harvest patterns** by providing greater protection for terrestrial mammals, fish and fish habitat, and birds during fuel use, handling, near rivers and lakes. A-5 limits the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we expect greater impacts from spills, reductions in water quality, loss of critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. A-5 would protect **water resources and water quality** by restricting fuel handling near lakes and rivers. A-5 could reduce impacts to **endangered and threatened species** by preventing spilled fuel from reaching waterbodies where individual eiders (including nesting or brood-rearing eiders occupying adjacent habitats) could become contaminated and die or if not lethal could adversely affect breeding success. A-5 would provide increased protection to **freshwater fish and fish habitat** during fuel use, handling, and storage. A-5 would reduce the potential for introducing fuel spills into environments inhabited by **marine fishes**. This ROP may reduce the number of individual fishes impacted by a spill and the intensity of lethal and sublethal exposure. A-5 would reduce the potential effects of fuel spills on grizzly bears, arctic foxes, and other **terrestrial mammals.**
A-6 Required Operating Procedure
Objective: Minimize the impact on fish, wildlife and the environment from contaminants associated with the exploratory drilling process. **Standard/Requirement:** Surface discharge of reserve-pit fluids is prohibited unless authorized by applicable NPDES, ADEC, and NSB permits (as appropriate) and approved by the AO.
A-6 Effectiveness
A-6 would reduce impacts on **subsistence-harvest patterns** by regulating the discharge of reserve pit fluids and thus minimizing impacts to fish and fish habitat and birds.

Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)
A-6 limits the impacts that oil and gas exploration and development will have on **wild and scenic river** values by regulating the discharge of reserve pit fluids. Without this ROP we expect greater reductions in water quality and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. A-6 would protect **water resources and water quality, freshwater fish habitat and fish, marine fishes, terrestrial mammals** and reduce the acreage of impacts to **vegetation** by regulating the discharge of reserve pit fluids.
A-7 Required Operating Procedure
Objective: To minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment. **Requirement/Standard:** Procedures for the disposal of produced fluids shall meet the following requirements: a) In upland areas, including wetlands, disposal will be by subsurface-disposal techniques. The AO may permit alternate disposal methods if the lessee demonstrates that subsurface disposal is not feasible or prudent and the alternative method will not result in adverse environmental effects. b) In marine waters, approval of discharges by the AO will be based on a case-by-case review of environmental factors and consistency with the conditions of an NPDES permit. Discharge of produced fluids will be prohibited at locations where currents and water depths, in combination with other conditions, are not adequate to prevent impacts to known biologically sensitive areas. Alternate disposal methods will require an NPDES permit certified by the State.
A-7 Effectiveness
A-7 would reduce impacts on **subsistence-harvest patterns** by regulating the disposal of produced fluids thus minimizing impacts to fish and fish habitat and birds. A-7 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values by regulating the disposal of produced fluids. Without this ROP we expect greater reductions in water quality and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. A-7 would protect **water resources and water quality, freshwater fish habitat and fish, marine fishes, terrestrial mammals** and reduce the acreage of impacts to **vegetation** by regulating the disposal of produced fluids.
A-8 Required Operating Procedure
Objective: Minimize conflicts resulting from interaction between humans and bears during leasing and associated activities. **Requirement/Standard:** Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a) Minimize attraction of bears to the drill sites. b) Organize layout of buildings and work areas to minimize human/bear interactions. c) Warn personnel of bears near or on drill sites and identify proper procedures to be followed. d) Establish procedures, if authorized, to deter bears from the drill site. e) Provide contingencies in the event bears do not leave the site or cannot be deterred by authorized personnel. f) Discuss proper storage and disposal of materials that may be toxic to bears. g) Provide a systematic record of bears on the site and in the immediate area.

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A-8 Effectiveness

A-8 would benefit the **recreation and wilderness** users of the area by minimizing acclimatization of bears to human contact.

A-8 would benefit **terrestrial mammals** by requiring a bear-interaction plan that would reduce impacts to grizzly bears by reducing human/bear interactions. This ROP would benefit bears by reducing both the number of bears killed in "defense of life and property" and the number of bears becoming habituated to anthropogenic food sources.

B. Water Use for Permitted Activities

B-1 Required Operating Procedure

Objective: To maintain populations of, and adequate habitat for, fish and invertebrates.

Requirement/Standard: Water withdrawal from rivers and streams during winter is prohibited.

B-1 Effectiveness

B-1 could reduce impacts to some **bird species** by preventing winter die-off of fish prey of fish-eating birds (e.g., loons, mergansers, terns), which could adversely affect the breeding success of these water bird species.

B-1 would reduce impacts on **subsistence-harvest patterns** by providing increased protection to fish and fish habitat by prohibiting water withdrawals from rivers and streams.

B-1 would preserve instream flows in **eligible wild and scenic** rivers and limit the impacts that oil and gas exploration and development would have on river values. Without this restriction we would expect greater impacts from reductions in water quality, reductions in critical flows, obstruction to fish passage, loss of critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

B-1 would protect **water resources and water quality** by prohibiting water withdrawal from rivers during winter.

B-1 would prohibit water withdrawals from rivers and protect overwintering habitat for **freshwater fish**.

B-2 Required Operating Procedure

Objective: To maintain natural hydrologic regimes in soils surrounding lakes and ponds and maintain populations of, and adequate habitat for, fish and invertebrates.

Requirement/Standard: Water withdrawal from lakes may be authorized on a site-specific basis depending on size, water volume, depth and fish population and species diversification. Current water withdrawal requirements specify:

a) Water withdrawals from any fish bearing lake 7 ft or deeper shall be limited to 15 percent of the estimated free water volume located beneath ice.

b) Water withdrawals from lakes with depths between 5 and 7 ft that contain only ninespine stickleback and/or Alaska blackfish are limited to up to 30 percent of the under-ice volume.

c) Water withdrawal may be authorized from any lake if the proponent demonstrates that no fish exist in the lake.

d) A water-monitoring plan may be required to assess draw down and water quality changes before, during, and after pumping any fish-bearing lake.

e) The removal of naturally grounded ice may be authorized from lakes and shallow rivers on a site-specific basis depending upon its size, water volume, depth, and fish population and species diversification.

f) Removed ice aggregate shall be included in the 15 percent or 30 percent, whichever is the appropriate case, withdrawal limits unless otherwise approved.

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g) Any water intake structures in fish-bearing waters shall be designed, operated and maintained to prevent fish entrapment, entrainment, or injury.
h) Compaction of snow cover or snow removal from fish-bearing water bodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes or areas of grounded ice.

B-2 Effectiveness

B-2 could reduce impacts to some **bird** species by preventing winter die-off of fish prey of fish-eating birds (e.g., loons, mergansers, terns), which could adversely affect the breeding success of these water bird species.
B-2 would reduce impacts on **subsistence-harvest patterns** by providing increased protection to fish and fish habitat and by limiting water withdrawals from certain lakes.
B-2 would protect **water resources and water quality** by regulating amounts of winter water withdrawals from lakes.
B-2 would regulate water withdrawals from lakes and protect overwintering habitat for **freshwater fish**.

C. Winter Overland Moves and Seismic Work

The following stipulations and ROP's apply to overland moves, seismic work, and any similar cross country vehicle use of heavy equipment on non-roaded surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.

C-1 Required Operating Procedure

Objective: To protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.
Requirement/Standard:
a) Cross country use of heavy equipment and seismic activities are prohibited within ½ mi of occupied grizzly bear dens identified by ADF&G unless alternative mitigation measures are approved by the AO in consultation with ADF&G.
b) Cross-country use of heavy equipment and seismic activities are prohibited within 1 mi of known or observed polar bear dens or seal birthing lairs. Operators shall consult with the U.S. Fish and Wildlife Service (FWS) and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.

C-1 Effectiveness

C-1 would prevent some disturbances of **marine mammals** , specifically denning **polar bears** and seals.
C-1 would reduce impacts on subsistence use patterns by protecting **grizzly bears** and some **marine mammals**.
C-1 would benefit **terrestrial mammals** by requiring avoidance of known grizzly bear dens that would potentially reduce impacts to denning grizzly bears from seismic operations. The success of this ROP would be relative to the effort made to locate bear dens before initiating work.

C-2 Required Operating Procedure

Objective: To protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.
Requirement/Standard:
a) Ground operations shall be allowed only when frost and snow cover are at sufficient depths to protect the tundra. Ground operations shall cease when the spring snowmelt begins, approximately May 5 in the foothills area where elevations reach or exceed 500 ft and approximately May 15 in the northern coastal areas. The exact dates will be determined by the AO.

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b) Only low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. A current list of approved vehicles can be obtained from the AO. Limited use of tractors equipped with wide tracks or "shoes" will be allowed to pull trailers, sleighs or other equipment with approved undercarriage. Note: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction.

c) Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed.
d) To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons.
e) The location of winter ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.

C-2 Effectiveness

C-2 would reduce impacts on subsistence use patterns by providing increased protection to **fish** and fish habitat.
C-2a would benefit the wilderness resources and users of the area by limiting ground disturbance from winter use of heavy equipment and seismic activity.
C-2 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we would expect greater damage to stream banks at river crossings, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.
C-2 would protect **water resources and water quality** by regulating overland moves, seismic work, ice-road construction, and other heavy equipment travel during the winter to limit impacts to water resources.
C-2 would reduce the level of impacts to **vegetation** by reducing impacts of off-road vehicles.
C-2a, c, and e would provide protection from seismic and overland move activities that could potentially disturb the vegetative mat and impact **paleontological and cultural** resources that are near the surface.
C-2 would be beneficial to **freshwater fish habitat and fish** by reducing damage to stream banks at river crossings and reducing rutting and other damage to the vegetative mat.
C-2 would put restrictions on the types of heavy equipment used and the seasons of allowable use and would be beneficial to **terrestrial mammals** by reducing the amount of habitat disturbed during overland moves and seismic work. Use of low-pressure vehicles may also reduce the mortality of small mammals.
C-2 would provide protection for **soils** by reducing damage to stream banks, reducing rutting, and generally reducing impacts to vegetation by restricting seismic activity and overland moves to winter

C-3 Required Operating Procedure

Objective: To maintain natural spring runoff patterns, avoid flooding, prevent streambed sedimentation, protect water quality and protect stream banks.
Requirement/Standard: Snow and ice bridges shall be removed, breached or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.

Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)
C-3 Effectiveness
C-3 would reduce impacts on **subsistence-use patterns** by providing increased protection to fish and fish habitat. C-3 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP, we would expect greater reductions in water quality, reductions in critical flows, obstruction to fish passage and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. equipment travel during the winter. C-3 would protect **water resources and water quality** by regulating overland moves, seismic work, ice-road construction, and other heavy C-3 would be beneficial to **freshwater fish habitat and fish** by reducing stream sedimentation, maintaining water quality and maintaining natural spring runoff.
C-4 Required Operating Procedure
Objective: To avoid additional freeze down of deep-water pools harboring over-wintering fish and invertebrates used by fish. **Requirement/Standard:** Rivers and streams shall be crossed at shallow riffles from point bar to point bar whenever possible.
C-4 Effectiveness
C-4 would reduce impacts on **subsistence-harvest patterns** by providing increased protection to fish and fish habitat. C-4 limits the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we expect greater loss of critical winter habitat, and declines in outstandingly remarkable values for fish and subsistence use. C-4 would protect **water resources and water quality** by regulating heavy equipment travel across streams and rivers during the winter. C-4 would protect **fish** by avoiding additional freezedown of overwintering pools in rivers.
D. Oil and Gas Exploratory Drilling
D-1 Lease Stipulation
Objectives: To protect fish-bearing rivers, streams and lakes from blowouts and to minimize alteration of riparian habitat. **Requirement/Standard:** Exploratory drilling is prohibited in rivers and streams, as determined by the active floodplain, and fish-bearing lakes, except where the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative.
D-1 Effectiveness
D-1 would reduce impacts on **subsistence-harvest patterns** by providing increased protection for terrestrial mammals. D-1 would limit the impacts that oil and gas exploration and development will have on **wild and scenic** river values. Without this stipulation we would expect a greater risk of impacts from blowouts to water quality, critical winter habitat, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. D-1 would protect **water resources and water quality** by prohibiting exploratory drilling in shallow lakes, streams, and floodplains. D-1 would reduce impacts to **fish** and fish habitat during oil and gas exploratory drilling. D-1 would reduce the potential for damage to the riparian habitats that are so important to many species of **terrestrial mammals**, including moose, bear and wolverine by prohibiting exploratory drilling in active floodplains. Disturbance impacts to wolverines and moose would also be reduced.
D-2 Lease Stipulation

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Objective: To minimize surface impacts from exploratory drilling.
Requirement/Standard: Exploratory drilling shall be limited to temporary facilities such as ice pads, ice roads, ice airstrips, temporary platforms, etc., unless the lessee demonstrates that construction of permanent facilities such as gravel airstrips, storage pads, and connecting roads is environmentally preferable or necessary to carry out exploration more economically.

D-2 Effectiveness

D-2 could influence the level of effects on **estuarine water quality** by limiting exploratory drilling to temporary facilities such as ice pads. However, ice islands have been a relatively inexpensive and common type of facility for exploration in the nearshore Beaufort Sea, so ice islands might be the main type of exploration facility that would be used in NPR-A estuaries, even without the stipulation. Therefore, the stipulation might have only a minor effect on the types of exploration facilities that are used—and minor beneficial effect on estuarine water quality. In summary, the Stipulation would probably moderate the effects of exploration facilities and long causeways on estuarine water quality, but would not eliminate the effects.

E. Facility Design and Construction

E-1 Required Operating Procedure

Objective: To protect subsistence use and access to traditional subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources.
Requirement/Standard: All roads must be designed, constructed, maintained and operated to create minimal environmental impacts and to protect subsistence use and access to traditional subsistence hunting and fishing areas. Subject to approval by the AO, the construction, operation and maintenance of oil field roads is the responsibility of the lessee. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes. This preserves the opportunity to plan, design and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within NPR-A.

E-1 Effectiveness

E-1 could be effective in minimizing effects on **soils** through the design and construction of facilities that incorporate design elements that may reduce erosion.
E-1 would provide protection against impeding subsistence pursuits as set down in ANILCA (P.L. 96-487) and would also give mitigative relief for **sociocultural** impacts. Specifically for subsistence, ROP E-1 protects **subsistence use and access** to traditional hunting and fishing areas, Protection of subsistence pursuits helps to guard against potential sociocultural disruptions that then fall under the purview of **environmental justice**.
E-1 would limit the impact that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP, we would expect greater impacts from road construction, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

E-2 Lease Stipulation

Objective: To protect fish-bearing water bodies, water quality and aquatic habitats.
Requirement/Standard: The design and location of permanent oil and gas facilities within 500 ft of fish-bearing or 100 ft of non fish-bearing waterbodies will only be approved on a case by case basis if the lessee can demonstrate that impacts to fish, water quality, and aquatic and riparian habitats are minimal. Note: Also refer to Area-Specific Stipulations and ROP's for Rivers (Stipulation K-1) and Deep Water Lakes (Stipulation K-2).

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Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)
E-2 Effectiveness
E-2 could reduce the loss (burial) of wetland habitats, important for many species of **birds** in particular breeding loons, waterfowl and shorebirds, by restricting approval for location of permanent oil and gas facilities within 500 ft of fish-bearing water bodies or 100 ft of non fish-bearing water bodies to those that are likely to cause minimal impacts to wildlife. E-2 would reduce impacts on **subsistence use patterns** by providing increased protection to fish and fish habitat by reducing the likelihood of fuel or oil contaminating waterbodies. E-2 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this stipulation we would expect greater impacts from spills, reductions in water quality, and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. E-2 would protect **water resources and water quality** by limiting certain facility, structure, and gravel mine site design and construction impacts near lakes and rivers. E-2 would not reduce the acreage of **vegetation** impacted by an action, but might shift the impacts from more valuable wetland or riparian vegetation types to habitats perceived as lesser in value. E-2 would reduce impacts to **endangered and threatened species** by reducing the loss (burial) of wetland habitats, important for breeding eiders, by restricting approval for location of permanent oil and gas facilities within 500 ft of fish-bearing water bodies or 100 ft of non fish-bearing water bodies to those that are likely to cause minimal impacts to wildlife. E-2 would be beneficial to **freshwater fish habitat and fish.**
E-3 Lease Stipulation
Objective: To maintain free passage of marine and anadromous fish and to protect subsistence use and access to traditional subsistence hunting and fishing.
E-3 Lease Stipulation
Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program may be required to address the objectives of water quality and free passage of fish.
E-3 Effectiveness
E-3 would provide protection against impeding subsistence pursuits as set down in ANILCA (P.L. 96-487) and would also mitigate for **sociocultural** impacts, as well. Specifically for subsistence, ROP E-3 protects **subsistence use and access** to traditional hunting and fishing areas, Protection of subsistence pursuits helps to guard against potential sociocultural disruptions that then fall under the purview of **environmental justice** E-3 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this stipulation we would expect greater impacts from spills, reductions in water quality, reductions in critical flows, obstruction to fish passage and declines in outstandingly remarkable values for fish, wildlife, and subsistence use. E-3 would protect **water resources and water quality** by prohibiting causeways and docks in river mouths and deltas and by setting certain design criteria for causeways, docks and other structures.

Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)
E-3 would reduce potential for disruption of **freshwater fish** passage.
E-4 Required Operating Procedure
Objective: To minimize the potential for pipeline leaks, the resulting environmental damage and industrial accidents. **Requirement/Standard:** All pipelines shall be designed, constructed, and operated under an AO-approved Quality Assurance/Quality Control plan that is specific to the product transported.
E-4 Effectiveness
E-4 would reduce impacts on **subsistence-harvest patterns** by minimizing risk of pipeline leaks thus providing increased protection to terrestrial mammals, fish and fish habitat, and marine mammals. E-4 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without these stipulations, we would expect greater impacts from spills, and resulting reductions in water quality, outstandingly remarkable values for fish, wildlife, and subsistence use. E-4 would reduce the probability of oil spills thus reducing the potential for associated impacts to **vegetation**. E-4 would reduce the potential for pipeline spills or blowouts due to manufacturing, maintenance or operation failures. This would reduce the potential for direct mortality of **terrestrial mammals** due to toxic exposure and the contamination of prey and forage. There would be fewer spills, resulting in less cleanup activity along pipelines and fewer disturbance impacts to terrestrial mammals.
E-5 Required Operating Procedure
Objective: Minimize impacts of the development footprint. **Requirement/Standard:** Facilities shall be designed and located to minimize development footprint to the maximum extent practicable considering environmental, economic, and social impacts. Note: Where aircraft traffic is an issue, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.
E-4 Effectiveness
E-5 could minimize **bird** habitat burial and disturbance by requiring minimal facility footprint and reduction in air traffic. E-5 would be effective in minimizing effects on **soils** by minimizing the development footprint. E-5 would be effective in minimizing effects on **vegetation** by minimizing the development footprint. E-5 would minimize impacts of the development footprint so as to reduce environmental and **sociocultural** impacts. It will also reduce impacts to **subsistence-harvest patterns**. E-5 would reduce impacts 'to **endangered and threatened species** by requiring minimal facility footprint which would minimize eider habitat burial and disturbance. E-5 would require the lessee to minimize the development footprint and would be beneficial to **terrestrial wildlife** in that it would reduce the amount of habitat lost and decrease disruption of caribou movements. Conversely, it would also reduce the amount of gravel habitats created that can be used to advantage by ground squirrels. Although caribou may also use gravel pads for insect-relief habitat, the negative effects of development outweigh any positive impacts. Overall, the effect of this ROP would be beneficial to most terrestrial wildlife.
E-6 Required Operating Procedure
Objective: To reduce the potential for ice-jam flooding, erosion, and restriction of fish passage.

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Requirement/Standard: Water crossings shall be designed and constructed to ensure free passage of fish, maintain natural drainage, and minimal adverse effects to natural stream flow. Note: Bridges, rather than culverts, are the preferred method for crossing rivers. When necessary, culverts can be constructed on smaller streams, if they are large enough to avoid restricting fish passage or adversely affecting natural stream flow.

E-6 Effectiveness

E-6 would reduce impacts on **subsistence-harvest patterns** by reducing the risk of restricting passage of fish.

E-6 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we expect greater impacts due to the obstruction to fish passage and declines in outstandingly remarkable values for fish, and subsistence use.

E-6 could be **effective** in minimizing effects on **soils** by maintaining natural drainages that may reduce erosion.

E-6 would protect **water resources** and **water quality** by requiring that water crossings be designed and constructed to maintain natural drainage and to have minimal adverse effects to natural stream flow.

E-6 would be beneficial to **freshwater fish** habitat and fish by requiring that water crossings be designed and constructed to ensure free passage of fish and to maintain natural drainage and to have minimal adverse effects to natural stream flow.

E-7 Required Operating Procedure

Objective: To minimize disruption of caribou movement and subsistence use.

Requirement/Standard: Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in traditional subsistence activities. Listed below are the currently accepted design practices:

a) Above ground pipelines shall be elevated an average of at least 7 ft as measured from the ground to the bottom of the pipeline (except where pipelines intersect a road, pad, in transition zones between buried and elevated pipelines or at ramps installed to facilitate wildlife passage and subsistence passage and access).

b) In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the AO after consultation with Federal, State and North Slope Borough regulatory and resource agencies (as appropriate-based on agency legal authority and jurisdictional responsibility).

c) A minimum distance of 500 ft between pipelines and roads should be maintained when feasible. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad.

E-7 Effectiveness

E-7 could increase the potential for **bird** collisions with pipelines by requiring that aboveground pipelines be elevated to 7 feet above the surface.

E-7 reduces **sociocultural** impacts and disruption of **subsistence-harvest patterns** by minimizing the disruption of caribou movement by requiring pipelines and roads to be designed to allow the free movement of caribou and the safe and unimpeded passage of subsistence hunters.

E-7 could increase impacts to **endangered and threatened species** by increasing the potential for eider collisions with pipelines by requiring that above ground pipelines be elevated at least 7 feet above the surface.

E-7 would greatly reduce impacts of oil development on caribou and other large **terrestrial mammals by** requiring design of roads and pipelines to allow for free movement of caribou. Pipeline height of 7 ft, and separation of roads and pipelines by 500 ft would facilitate movement of TLH caribou from insect-relief habitat to inland foraging habitat. This ROP would reduce but not eliminate impacts of oil development on caribou movements. Since caribou are sensitive to humans on foot and moving vehicles, there would be some negative effects on their ability to freely move through the

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area regardless of how well the facilities were designed.
E-8 Required Operating Procedure
Objective: To minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. **Requirement/Standard:** Gravel mine site design and reclamation will be in accordance with a plan approved by the AO. The plan shall consider: a) Locations outside the active flood plain. b) Design and construction of gravel mine sites within active flood plains to serve as water reservoirs for future use. c) Potential use of site for enhancing fish and wildlife habitat.
E-8 Effectiveness
E-8 would reduce impacts on **subsistence-harvest patterns** by reducing the impact of gravel mining operations on birds, fish and fish habitat. E-8 would be effective in minimizing effects on **soils** through the design and reclamation of mine sites that reduce erosion and maintain natural drainages. E-8 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we would expect greater reductions in water quality declines in outstandingly remarkable values for fish, wildlife, and subsistence use. E-8 would protect **water resources and water quality** by limiting gravel mine site design and construction impacts. E-8 could increase the probability that altered **vegetation** would eventually be returned to a natural (or at least more productive) state. E-8 would be beneficial to **freshwater fish** habitat and fish.
E-9 Required Operating Procedure
Objective: To prevent human-caused increases in populations of predators of ground nesting birds. **Requirement/Standard:** Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the AO with an annual report on the use of oil and gas facilities by ravens, raptors and foxes as nesting, denning, and shelter sites.
E-9 Effectiveness
E-9 could benefit some **birds** through avoiding artificial enhancement of bird predators by requiring use of best available technology to prevent facilities from providing nesting, denning, or shelter sites for predators. E-9 would provide increased protection for **subsistence-harvest patterns** by providing protective measures for birds. E-9 could reduce impacts to **endangered and threatened species** by avoiding artificial enhancement of eider predators by requiring use of best available technology to prevent facilities from providing nesting, denning, or shelter sites for predators.
E-10 Required Operating Procedure
Objective: To prevent migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions. **Requirement/Standard:** Except for safety lighting, illumination of higher structures shall be designed to direct artificial exterior lighting inward and

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downward, rather than upward and outward. All drilling structures, production facilities, and other structures that exceed 20 ft shall be illuminated as outlined above.
E-10 Effectiveness
E-10 could reduce collisions of **birds** with oil and gas facilities during low light by requiring that exterior lights be directed inward and downward. E-10 would reduce impacts on **subsistence-harvest patterns** by providing protective measures for birds. E-10 could reduce impacts to **endangered and threatened species** by reducing collisions of eiders with oil and gas facilities during low light conditions by requiring that exterior lights be directed inward and downward.
E-11 Required Operating Procedure
Objective: To minimize the take of species listed under the Endangered Species Act and minimize the disturbance of other species of interest from direct or indirect interaction with oil and gas facilities. **Requirement/Standard:** In accordance with the guidance below, before the approval of facility construction, aerial surveys of breeding pairs of the following species shall be conducted within any area proposed for development. **Spectacled and/or Steller's Eiders** a) Surveys shall be conducted by the lessee for at least three (3) years before authorization of construction, if such construction is within the FWS North Slope Eider survey area (Map 62), and at least one (1) year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol during the second week of June. b) If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall consult with the FWS and BLM in the design and placement of roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, construction of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and introduction of high noise levels. c) To reduce the possibility of spectacled and/or Steller's eiders from striking above ground utility lines (power and communication), such lines shall either be buried in access roads, or suspended on vertical support members, to the extend practical. Support wires associated with communication towers, radio antennas, and other similar facilities, shall be clearly marked along their entire length to improved visibility for low flying birds. Such markings shall be jointly developed through consultation with FWS.
E-11 Required Operating Procedure (continued)
Yellow-billed Loon a) Aerial surveys shall be conducted by the lessee for at least 3 years before authorization of construction of facilities proposed for development which are within 1 mi of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August. b) Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. Current accepted mitigation is a one-mile buffer around all recorded nest sites and a minimum 500-m buffer around the remainder of the lake shoreline. Development may be prohibited within buffers or activities curtailed while birds are present.
E-11 Effectiveness

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E-11 would reduce impacts on **subsistence-harvest patterns** by providing protective measures for birds.

E-11 could reduce impacts to **endangered and threatened species** by minimizing the take of ESA-listed eiders by requiring aerial surveys of breeding pairs in areas proposed for development, and through consultation with FWS and BLM concerning the design of structures before approval of any construction if listed eiders are present in such areas.

E-12 Required Operating Procedure

Objective: To ensure use of ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development.

Requirement/Standard: An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface-form and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the AO, before approval of exact facility location and facility construction.

E-12 Effectiveness

E-12 could help conserve important habitat types by requiring development of an ecological land classification map for use in siting permanent facilities. This would increase protection for **subsistence-harvest patterns** and would reduce **sociocultural** impacts by conserving important habitat types during development.

E-12 requiring an assessment of wildlife habitat prior to development of permanent facilities would facilitate site-specific mitigation of impacts to **terrestrial mammals** and should reduce the overall impact of development.

E-12 could mitigate impacts to **birds** by requiring development of an ecological land classification map for use in siting facilities.

E-12 could conserve habitat important to **endangered and threatened species** by requiring development of an ecological land classification map for use in siting facilities.

F. Use of Aircraft for Permitted Activities

F-1 Required Operating Procedure

Objective: To minimize the effects of low-flying aircraft on wildlife, traditional subsistence activities and local communities.

Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines.

a) Aircraft shall maintain an altitude of at least 1,500 ft above ground level (AGL) when within ½ mi of cliffs identified as raptor nesting sites from April 15 through August 15 and within ½ mi of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from BLM necessary to plan flight routes when routes may go near falcon nests.

b) Aircraft shall maintain an altitude of at least 1,000 ft AGL (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the AO.

c) The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered so as to allow larger aircraft to be employed resulting in a fewer number of flights to the facility.

d) Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.

e) Aircraft used for permitted activities shall maintain an altitude of at least 2,000 ft AGL (except for takeoffs and landings) over the Caribou Study

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Area (Map 91) from June 15 through July 31, unless doing so would endanger human life or violate safe flying practices.
f) Aircraft shall maintain an altitude of at least 2,000 ft AGL (except for takeoffs and landings) over the Caribou Coastal Insect-Relief Areas (Map 91) from June 15 through July 31, unless doing so would endanger human life or violate safe flying practices.

F-1 Effectiveness

F-1 could mitigate aircraft disturbance of **birds** by requiring that aircraft maintain an altitude of at least 1,500 ft AGL when within 1/2 mi of raptor nesting sites from April 15-August 15 or gyrfalcon nest sites from March 15-August 15, 2,000 ft AGL over the Caribou Study Area June 15-July31, and 2,000 ft AGL over the caribou coastal insect-relief areas June 15-July 31, and minimize the number of takeoffs and landings at all airstrips.
F-1 would benefit the **wilderness resources** and users of the area by reducing disturbance from noise.
F-1 would minimize the effects of low-flying aircraft on caribou, moose, bird populations and other wildlife and sensitive habitat areas, local communities, and traditional subsistence activities, especially during sensitive subsistence hunting periods (spring goose hunting and fall moose hunting. This would reduce impacts on **subsistence harvest patterns** and would reduce **sociocultural** impacts.
F-1 could reduce impacts to **endangered and threatened species** by reducing aircraft disturbance of eiders nesting in the vicinity of raptor nest sites, Caribou Study Areas or Insect Relief Areas, and airstrips by requiring that aircraft maintain an altitude of at least 1,500 ft AGL when within 1/2 mi of raptor nesting sites April 15-August 5 or gyrfalcon nest sites March 15-April 15, 2,000 ft AGL over the Caribou Study Area June 15-July31, and 2,000 ft AGL over the Caribou Coastal Insect Relief Areas June 15-July 31, and minimize the number of takeoffs and landings at all airstrips.
F-1 would minimize disturbance of **terrestrial mammals**, specifically caribou, by requiring minimum altitudes of 1,000 to 2,000 ft above ground level (AGL) for aircraft over occupied caribou winter range and caribou insect-relief areas, respectively, during critical times of the year.

G. Oil Field Abandonment

G-1 Lease Stipulation

Objective: To ensure the final disposition of the land meets the current and future needs of the public.
Requirement/Standard: Upon abandonment or expiration of the lease, all oil and gas related facilities shall be removed and sites rehabilitated to as near the original condition as practicable, subject to the review of the AO. The AO may determine that it is in the best interest of the public to retain some or all facilities.

G-1 Effectiveness

G-1 could influence the level of effects on **estuarine water quality** by requiring the removal of all oil and gas facilities upon abandonment of the operations; this would require the removal of, for example, offshore gravel islands. Gravel islands specifically would not have long-term effects, as described in Section 5. In contrast, long docks and causeways with inadequate breeches would probably have measurable, long-term impacts on hydrologic conditions, as concluded in Section 5. The removal of docks might be complicated by their connection to a road system and by their possible future use for non-oil activities. For example, West Dock has been used by subsistence hunters and could be used for general public shipping. So, there might be public objections to the removal of some facilities, moderating the stipulation's beneficial effects on water quality. In summary, the Stipulation G-1 would probably moderate the effects of exploration facilities and long causeways on estuarine water quality, but would not eliminate the effects.
G-1 would protect **water resources and water quality** by requiring removal and reclamation of developed sites upon field abandonment, which would eventually result in restoration of the natural drainage.
G-1 may increase the probability that altered **vegetation** would eventually be returned to a natural (or at least more productive) state.

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H. Subsistence Consultation for Permitted Activities

"Consultation" may take place by in-person meetings, teleconference, videoconference, and exchange of written documents, e-mail, or other means appropriate to the circumstances. Consultation does not include public meetings that are primarily for the purpose of information distribution, unless it is explained at the beginning of the meeting that there is an open dialogue, and that comments, concerns, or other information are being actively solicited.

H-1 Required Operating Procedure

Objective: To provide opportunities for participation in planning and decision-making to prevent unreasonable conflicts between subsistence uses and oil and gas and related activities.

Requirement/Standard: Lessee/permittee shall consult directly with affected communities using the following guidelines.

a) Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, the North Slope Borough, and the NPR-A Subsistence Advisory Panel to discuss the siting, timing and methods of proposed operations. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities.

b) The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to provide an adequate time for review and comment by the NPR-A Subsistence Advisory Panel and to allow time for formal government-to-government consultation with Native Tribal Governments. The applicant shall submit documentation of its consultation efforts and a written plan that shows how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Operations plans must include a discussion of the potential effects of the proposed operation, and the proposed operation in combination with other existing or reasonably foreseeable operations.

c) A subsistence plan addressing the following items must be submitted.

1. A detailed dercription of the activity(ies) to take place (including the use of aircraft).
2. A description of how the lessee/permittee will minimize and/or deal with any potential impacts identified by the AO during the consultation process.
3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community.
4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc.
5. Procedures necessary to facilitate access by subsistence users to conduct their activities.
6. In the event that no agreement is reached between the parties, the AO shall consult with the directly involved parties and determine which activities will occur, including the timeframes.
7. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the AO and Subsistence Advisory Panel.

H-1 Effectiveness

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H-1 would prevent unreasonable conflicts between subsistence uses and oil and gas and related activities. This would reduce impacts on **subsistence-harvest patterns** and would reduce impacts to **sociocultural systems** as well as address potential **environmental justice** concerns by providing opportunities for local participation in planning and decision-making.

H-1 would limit the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP, we would expect greater declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

H-2 Required Operating Procedure

Objective: To prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration.

Requirement/Standard: In addition to the consultation process described above for permitted activities, before applying for permits to conduct geophysical (seismic) exploration, the applicant shall consult with local communities and residents:

a) Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify in writing all potentially effected long-term cabin and camp users.

b) The official recognized list of cabin and campsite users is the North Slope Borough's 2001 (or most current) inventory of cabins and campsites.

c) For the purpose of this standard, potentially affected cabins and camp sites are defined as any camp or campsite within the boundary of the area subject to proposed geophysical exploration and/or within 1,200 ft of actual or planned travel routes used to supply the seismic operations while it is in operation.

d) A copy of the notification letter and a list of potentially affected users shall also be provided to the office of the appropriate Native Tribal Government.

e) Based on that consultation, the AO may prohibit seismic work up to 1,200 ft of any known, long-term, cabin or campsite. Generally, the AO will allow wintertime seismic work to be conducted within 300 ft of a long-term cabin or campsite that is not in use.

H-2 Effectiveness

H-2 would prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration. This ROP would reduce impacts on **subsistence harvest patterns** and would reduce impacts to **sociocultural** systems as well as address potential **environmental justice** concerns by providing opportunities for local participation in planning and decision-making.

H-2 would limit the impacts that oil gas exploration and development will have on **wild and scenic river** values. Without this ROP we would expect greater declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

I. Orientation Programs Associated with Permitted Activities

I-1 Required Operating Procedure

Objective: To minimize cultural and resource conflicts.

Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, required operating procedures, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the AO for review and approval and should:

a) Provide sufficient detail to notify personnel of applicable stipulations and required operating procedures as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region.

b) Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird

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colonies, and marine mammals, and provide guidance on how to avoid disturbance.

c) Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species.

d) Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating.

e) Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation.

f) Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities.

g) Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site.

h) Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee.

i) Include a module discussing bear interaction plans to minimize conflicts between bears and humans.

I-1 Effectiveness

I-1 could help reduce disturbance of **birds** by providing all personnel with information concerning applicable required operating procedures and stipulations, and the importance of not disturbing biological resources, habitats, and bird colonies.

I-1 would reduce impacts on **subsistence-use patterns** and would reduce **cultural** conflicts as well as address potential **environmental justice** concerns by providing a cultural orientation program for all oil and gas workers involved in NPR-A activities in order to minimize cultural and resource conflicts with local inhabitants.

I-1 would reduce the impacts that oil and gas exploration and development will have on **wild and scenic river** values. Without this ROP we would expect greater impacts on fish, birds, terrestrial mammals and declines in outstandingly remarkable values for fish, wildlife, and subsistence use.

I-1 would reduce the acreage of impacts to **vegetation** by mking personnel involved in oil- and gas-related activities more aware of applicable stipulations and ROP's and their purpose.

I-1 could reduce impacts to **endangered and threatened species** through helping to reduce disturbance of eiders by providing all personnel with information concerning applicable required operating procedures and stipulations, and importance of not disturbing biological resources, habitats, and bird colonies.

I-1 would reduce impacts on **terrestrial mammals** by making workers more aware of the potential impacts of their activities on wildlife. Education of employees should reduce the potential for harassment and direct mortality of terrestrial mammals. This ROP would reduce the likelihood of "defense of life and property" killing of bears.

K. Area-Specific Lease Stipulations and Required Operating Procedures

K-1 Lease Stipulation - Rivers

Objective: To minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values. (See ROP D-1 for restrictions on exploration activities.)

Requirement/ Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the stream bed and adjacent to the rivers listed below at the distances identified. These setbacks are measured from the centerline of the river as determined by the current hydrology at the time of application. The standard setback is ½ mi and increased to ¾ mi where subsistence cabin and campsites are numerous. Along the Colville River and a portion of the Ikpikpuk a 1-mi setback is required to protect important raptor habitat. (For locations along rivers where setback distances change, see Map 20.) On a case-by case basis, and in consultation with Federal, State, and North Slope Borough regulatory and resource agencies (as appropriate - based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings perpendicular to the main channel will be permitted (unless noted otherwise) through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event.

a) Colville River: a 1-mi setback from the northern bluff (or bank if there is no bluff) of the Colville River extending the length of that portion of the river within the Planning Area. Road crossings intended to solely support oil and gas activities are prohibited. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes. This preserves the opportunity to plan, design, and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within NPR-A.

b) Ikpikpuk River: a ¾-mi setback from the centerline of the Ikpikpuk River extending from the mouth south to Sec. 19, T7N, R11W, UM. From Sec. 19, T7N, R11W, UM to Sec. 4 T3N, R12W, UM, a 1-mile setback is required. Beginning at Sec. 4 T3N, R12W, UM, a ½-mi setback will be required to the confluence of the Kigalik River and Maybe Creek. NOTE: setback distances only apply to the west bank where the Ikpikpuk River is the Planning Area boundary.

c) Alaktak River: a ¾-mi setback from the centerline of the Alaktak River extending from the mouth to the Ikpikpuk River.

d) Chipp River: a ¾-mi setback from the centerline of the Chipp River extending from the mouth to the Ikpikpuk River.

e) Oumalik River: a ¾-mi setback from the centerline of the Oumalik River from the mouth upstream to Sec. 5, T8N, R14W, UM, and a ½-mi setback from Sec. 5, T8N, R14W, UM, upstream to Sec. 2, T5N, R15W, UM.

f) Titaluk River: a ½-mi setback from the centerline of the Titaluk River from the confluence with the Ikpikpuk River upstream to Sec. 1, T2N, R22W, UM.

g) Kigalik River: a ½-mi setback from the centerline of the Kigalik River from the confluence with the Ikpikpuk River upstream to the Planning Area boundary.

h) Maybe Creek: a ½-mi setback from the centerline of the Maybe Creek from the confluence with the Ikpikpuk River upstream to Sec. 8, T2S R6W, UM.

i) Topagoruk River: a ¾-mi setback from the centerline of the Topagoruk River from the mouth upstream to the confluence with Ishuktak Creek. A ½-mi setback from each bank upstream from the confluence with the Ishuktak to Sec. 3, T7N, R17W, UM.

j) Ishuktak Creek: a ½-mi setback from the centerline of Ishuktak Creek from the confluence with the Topagoruk River to Sec. 24, T8N, R16W, UM.

k) Meade River: a ¾-mi setback from the centerline of the Meade River upstream to Sec. 6, T6N, R21W, UM. A 1/2-mile setback from each bank upstream from Sec. 6, T6N, R21W, UM to the Planning Area boundary.

l) Usuktuk River: a ¾-mi setback from the centerline of the Usuktuk River upstream from the confluence with the Meade River to Sec. 36, T10N, R19W, UM.

m) Pikroka Creek a ¾-mi setback from the centerline of the Pikroka Creek upstream from the confluence with the Meade River to Sec. 11, T8N, R23W, UM.

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K-1 Lease Stipulation - River Setbacks

n) Nigisakturik River: a ¾-mi setback from the centerline of the Nigisakturik River upstream from the confluence with the Meade River to Sec. 1, T11N, R25W, UM.
o) Inaru River: a ¾-mi setback from the centerline of the Inaru River from the mouth upstream to Sec. 17, T15N, R25W, UM.
p) Kucheak Creek: a ¾-mi setback from the centerline of Kucheak Creek from the confluence with the Inaru River upstream to Sec. 20, T13N, R24W, UM.
q) Avalik River: a ½-mi setback from the centerline of the Avalik River along that portion of the river within the Planning Area.

K-1 Effectiveness

K-1 could mitigate disturbance of raptors nesting along listed waterways and other **birds** occupying adjacent corridors--as well as avoiding destruction of habitats--by prohibiting permanent oil and gas facilities within established setback zones along listed waterways.
K-1 would reduce impacts on **subsistence-harvest patterns** by specifically identifying the rivers of prime importance to subsistence and defining setback requirements. These setbacks protect against impeding subsistence pursuits, guard against potential **sociocultural** disruptions that then fall under the purview of **environmental justice**.
K-1 would protect aquatic, floodplain and riparian areas adjacent to rivers and although it might not reduce the total acreage of **vegetation** impacted by an action, it might shift the impacts from more valuable wetland or riparian vegetation types to habitats perceived as lesser in value.
K-1 could reduce the small potential for impacts to **paleontological and cultural resources** from spill cleanup by establishing setbacks along the major rivers and streams.
K-1 could reduce impacts to **endangered and threatened species** by helping to reduce disturbance of eiders nesting or occupying areas along identified waterways, as well as by avoiding destruction of habitats by prohibiting permanent oil and gas facilities within the listed setback areas.
K-1 would be beneficial to both **freshwater and marine fish and fish habitat** by reducing the potential for accidental spills to enter riverine waters which in turn could contaminate coastal/marine waters where marine fishes might be impacted. The setbacks also would increase the opportunity for oil spill response and cleanup to occur well before contaminants enter either riverine or coastal/marine fish habitats.

K-2 Lease Stipulation - Deep Water Lakes

Objective: To minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deep water lakes; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; impacts to subsistence cabin and campsites; and the disruption of subsistence activities.
Requirement/ Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within ¼ mi of the ordinary high water mark of any deep lake as determined to be in lake zone III, i.e., depth > 4m (Mellor, 1985). On a case-by case basis, and in consultation with Federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline, road crossings and other permanent facilities may be permitted through or in these areas where the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative.

K-2 Effectiveness

K-2 could reduce impacts to some **birds** by minimizing the loss of habitat of fish prey of fish-eating birds (e.g., loons, mergansers, terns), which could adversely affect the breeding success of these water bird species.

Effectiveness of Lease Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

K-2 Effectiveness (continued)

K-2 would provide increased protection to **subsistence-use patterns** by protecting fish and fish habitat.

K-2 would protect **water resources and water quality** by protecting aquatic and riparian areas adjacent to deep-water lakes.

K-2 could reduce impacts to **endangered and threatened species** by minimizing the loss of eider habitats, which could adversely affect their breeding success.

K-2 would be beneficial to **freshwater fish habitat and fish** by reducing the potential for accidental spills into deep-water lakes.

K-3 Lease Stipulation - Dease Inlet, Admiralty Bay, Elson Lagoon, and Associated Barrier Islands

Lease stipulations, for Dease Inlet, Admiralty Bay, Elson Lagoon, and the Barrier Islands, contain specific criteria that have been incorporated into stipulation language. Because of sensitive biological resources and/or subsistence concerns of Dease Inlet, Admiralty Bay, Elson Lagoon, and inland of the Barrier Islands, the standard(s) for exploration and development activities are set high with the burden of proof resting with the lessee to demonstrate to the AO that granting an approval is warranted.

Objective: Protect fish and wildlife habitat, preserve air and water quality, and minimize impacts to traditional subsistence activities and historic travel routes on Dease Inlet, Admiralty Bay, and Elson Lagoon.

Requirement/Standard (Exploration): Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on Dease Inlet, Admiralty Bay, and Elson Lagoon (including natural and barrier islands), between May 15 and October 15 of each season. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the Authorized Office that the actions or activities meets all of the following criteria:

a) Exploration activities will not unreasonably conflict with traditional subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.

b) There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or, the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures, and "top-setting" of hydrocarbon-bearing zones.

c) Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses.

d) The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use traditional subsistence-related travel routes into and through Dease Inlet, Admiralty Bay and Elson Lagoon, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.

e) Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope

Requirement/Standard (Development): With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within ¾ mi seaward of the shoreline (as measured from mean high tide) of Dease Inlet, Admiralty Bay, and Elson Lagoon or the natural islands (excluding Barrier Islands). Elsewhere, permanent facilities within Dease Inlet, Admiralty Bay, and Elson Lagoon will only be permitted on or under the water if they can meet all the following criteria:

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f) Design and construction of facilities shall minimize impacts to traditional subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.
g) Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to traditional subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
h) The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through Dease Inlet, Admiralty Bay and Elson Lagoon as identified by the North Slope Borough.
i) Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and "top-setting" of hydrocarbon-bearing zones.
j) Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound "direct spill" related impacts on area resources and subsistence uses.
k) Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.
K-3 Effectiveness
K-3 could protect **bird** habitats and avoid disturbance of seasonally concentrated birds by prohibiting oil and gas exploration activity between May 15-October 15, requiring adequate year-round spill response capability including during periods of broken ice or alternative methods to prevent oil spills, requiring that facilities minimize impacts to seasonally concentrated birds, and requiring that daily activities are conducted to minimize impacts to seasonally concentrated birds.
K-3 would be most effective in protecting **estuarine water quality** by potentially moderating the effect of exploration spills on estuarine water quality. As noted above, a 500- or 900-bbl spill during the open water season would form a slick and dissolve partially in the water column. The hydrocarbon concentration might exceed the 0.015-ppm chronic criteria for up to 30 days in an area that ranges up to 70 mi^2 (180 km^2) in size. The stipulation could potentially moderate this effect because exploration operations might be limited to the solid-ice season—a period for which spill response tactics could recover most of the oil (US DOI, MMS, 2003:Sec. IV.A.6). However, the stipulation explains also (Part. b) that the solid-ice restriction would end with, in part, demonstration of "adequate spill response capability to effectively respond during periods of broken ice and/or open water. . . ." The MMS, which has approval authority on oil spill contingency plans for offshore facilities, describes the existing response capabilities in the document above, noting that "offshore operators in the Beaufort Sea currently maintain spill response, containment, and collection equipment to respond to releases the entire year" (US DOI, MMS, 2003:Sec. IV.A.6.a). So, approval of spill-response capability during open-water and broken-ice season might occur upon initiation of NW NPR-A exploration operations. Open-water spill responses generally recover about a third of the spilled oil, leaving some in the water column, so approval of open-water responses could increase inadvertently the effects on water quality. If open-water and broken-ice spill plans are not approved, the chance of estuarine spills would not be eliminated because a few operations could be conducted anyway. For example, the stipulation would restrict operations that are permitted, but would not apply to non-permitted operations,

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K-3 Effectiveness (continued)

including the barging of fuel which is conducted always during the open-water season with US Coast Guard-approved spill-contingency plans. In summary, the effectiveness of Stipulation K-3 is hard to assess without a more specific performance-based requirement of what would demonstrate "adequate spill response capability to effectively respond".

K-3 would reduce effects on **marine mammals** by not allowing oil and gas exploration operations on Dease Inlet, Admiralty Bay, and Elson Lagoon including natural and barrier islands, between May 15 and October 15 of each season. This measure would avoid disturbance of spotted seals and other marine mammals during the open water season. There would be a setback 3/4 mile from the shore and around natural islands (excluding the barrier islands) where no development could occur on or under the water. This setback would include Oarlock Island in Admiralty Bay an important haul-out area for spotted seals. This stipulation would minimize disturbance and habitat effects on spotted seals in the Dease Inlet-Admiralty Bay area. K-3 also addresses oil spill cleanup capability, and oil spill response activities that could help to minimize effects on marine mammals in the Dease Inlet-Admiralty Bay and Elson Lagoon areas.

K-3 would protect subsistence resources and access in Dease Inlet, Admiralty Bay, and Elson Lagoon. This protection of subsistence pursuits as set down in ANILCA (P.L. 96-487); helps to guard against potential impacts to **subsistence-harvest patterns**, **sociocultural** disruptions that then fall under the purview of **environmental justice**.

K-3 could reduce impacts to **endangered and threatened species** by protecting eider habitats and avoiding disturbance of seasonally concentrated eiders by 1) prohibiting oil and gas exploration activity between May 15-October 15, 2) requiring adequate year round spill response capability including during periods of broken ice or alternative methods to prevent oil spills (K-3 b), requiring that facilities minimize impacts to seasonally concentrated birds (K-3 f), and requiring that daily activities are conducted to minimize impacts to seasonally concentrated eiders (K-3g).

K-3 would prohibit oil and gas exploration operations on Dease Inlet, Admiralty Bay, and Elson Lagoon (including natural and barrier islands) between the periods of May 15 and October 15 of each season and requires adequate year round spill response capability including during periods of broken ice. This reduces the potential for impacts to **freshwater and marine fishes and their habitat** from oil and gas operations.

K-4 Required Operating Procedure - Brant Survey Area

Objective: To minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing brant in the Brant Survey Area.

Requirement/Standard:

a) Aerial surveys for brant nesting colonies and brood-rearing areas shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding ½-mi area. These surveys shall be conducted following accepted BLM protocol.

b) Development may be prohibited or activities curtailed within ½ mi of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.

K-4 Effectiveness

K-4 would reduce impacts to **birds** by reducing habitat loss or disturbance of nesting and brood-rearing brant by requiring pre-construction aerial surveys of proposed development sites and surrounding area, and by prohibiting development or curtailing activities within 1/2 mi of brant colonies. and brood-rearing areas.

K-4 would reduce impacts to **subsistence-harvest patterns** by protecting brant.

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K-5 Required Operating Procedure - Caribou Study Area
Objective: To minimize hindrance or alteration of caribou movements through insect-relief habitat. **Requirement/Standard:** Before authorization of construction of permanent facilities, the lessee shall design and implement a study of caribou movement, especially during the insect season. The study would include a minimum of 3 years of current data on caribou movements. The study design shall be approved by the AO and should provide information necessary to determine facility (including pipeline) design and location. Lessees may submit individual study proposals or they may combine with other lessees in the area to do a single, joint study for the entire Caribou Study Area. Study data may be gathered concurrently with other activities.
K-5 Effectiveness
K-5 would greatly reduce but not totally eliminate impacts to **terrestrial mammals**, specifically TLH caribou. The presence of facilities and associated human activity would still result in disturbance impacts to caribou. Caribou distribution can vary from year to year depending upon many factors. What appears to be the best design and location based on a minimum of three years of data may not hold true over the life of the facility or may be altered as additional infrastructure is constructed in other areas. K-5 would reduce impacts on **subsistence use patterns** by providing increased protection to caribou.
K-6 Lease Stipulation - Coastal Areas
Objective: To minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; to prevent contamination of marine waters; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. **Requirement/Standard:** In the Coastal Area, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines established to support exploration and development activities shall be located at least ¾ mi inland from the coastline to the extent practicable. Where, as a result of technological limitations, economics, logistics, or other factors, a facility must be located within ¾ mi inland of the coastline, the practicality of locating the facility at previously occupied sites such as the former Cape Simpson, Peard Bay, or Wainwright DEW-line sites shall be considered. Use of existing sites within ¾ mi of the coastline shall also be acceptable where it is demonstrated that use of such sites will reduce impacts to shorelines or otherwise be environmentally preferable. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users.
K-6 Effectiveness
K-6 would not reduce the acreage of **vegetation** impacted by an action, but might shift the impacts from more valuable wetland or riparian vegetation types to habitats perceived as lesser in value. K-6 would require permanent oil and gas facilities to be located 3/4 mi inland from the coastline to the extent practicable. This stipulation would thereby reduce the potential for accidental spills to enter coastal/marine waters where **marine fishes** might be impacted. They would increase the opportunity for oil spill response and cleanup well before they enter either riverine or coastal/marine fish habitats; consequently, they reduce the potential for a spill to adversely impact marine fishes. K-6 would reduce impacts on **subsistence harvest patterns** by providing increased protection to caribou, birds and marine fish and mammals. K-6 would help to prevent large fuel or crude oil spills, and consequently reduce the small potential for impacts to **paleontological and cultural** resources from spill cleanup.

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K-7 Required Operating Procedure - Colville River Special Area
Objective: To prevent or minimize loss of raptor foraging habitat. **Requirement/Standard:** If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as feasible. Within 15 mi of raptor nest sites, significant alteration of high quality foraging habitat shall be prohibited unless the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative. Of particular concern are ponds, lakes, wetlands, and riparian habitats. Note: On a case-by case basis, and in consultation with appropriate Federal and State regulatory and resource agencies, essential pipeline and road crossings will be permitted through these areas where no other options are available.
K-7 Effectiveness
K-7 could reduce impacts on **birds**--specifically important habitats of raptors occupying surrounding areas in the Colville River Special Area--by prohibiting, within 15 miles of raptor nest sites, significant alteration of high-quality raptor foraging habitat, particularly in waterbody, wetland, and riparian habitats. K-7 would not reduce the acreage of **vegetation** impacted by an action, but might shift the impacts from more valuable wetland or riparian vegetation types to habitats perceived as lesser in value. K-7 could reduce impacts to **endangered and threatened species** by reducing impacts on important habitats of eiders occupying the Colville River Special Area by prohibiting, within 15 miles of raptor nest sites, significant alteration of high-quality raptor foraging habitat, particularly in waterbody, wetland, and riparian habitats.
K-8 Lease Stipulation - Kasegaluk Lagoon Special Area
Objective: To protect the habitat of the fish, waterfowl, and terrestrial and marine wildlife resources of Kasegaluk Lagoon. To protect traditional subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents. **Requirement/Standard:** Within the Kasegaluk Lagoon Special Area, oil and gas leasing is approved subject to the decision to defer the implementation of oil and gas leasing in the "Leasing Deferral Area." When leasing is implemented, no permanent oil and gas facilities are permitted within the boundary of the Special Area. Geophysical (seismic) exploration is authorized subject to the terms and conditions provided in other applicable ROP's. No restrictions are imposed on traditional subsistence activities and access for subsistence purposes.
K-8 Effectiveness
K-8 could protect **birds** using Kasegaluk Lagoon by prohibiting permanent oil and gas facilities within the boundary of the Special Area. K-8 could reduce impacts to **endangered and threatened species** by protecting eiders using Kasegaluk Lagoon by prohibiting permanent oil and gas facilities within the boundary of the Special Area. K-8 would be beneficial to **freshwater fish** and habitat by prohibiting permanent oil and gas facilities within the boundary of the Special Area.

ROP = Required Operating Procedure

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Appendix [illegible]: Standardized Stipulations Applied to Mitigate the Impacts of Non-Oil and Gas Authorizations........[illegible]

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Appendix 13. Standardized Stipulations Applied to Mitigate the Impacts of Non-Oil and Gas Authorizations

Following is a list of stipulations that BLM commonly applies to authorizations it issues in the Northwest NPR-A Planning Area to mitigate the impacts of these activities. It is very unlikely that any authorization would contain most of these stipulations. Rather, depending on the nature of the activity being authorized, the time of year during which the activity would occur, and the lands and resources likely to be impacted by the activity, different stipulations from this list would apply. "Holder" refers to the party receiving use authorization from BLM; in some authorizations the term is modified to Permittee, Lessee, or other similar designation.

1. All operations will be conducted in such a manner as not to cause damage or disturbance to any fish or wildlife or to subsistence resources.
2. Chasing by vehicles or buzzing by aircraft of any wildlife is prohibited. Particular attention will be given to not disturbing caribou.
3. Holder shall prohibit the feeding of wildlife. Garbage or other potentially edible items, which would attract wildlife, shall be kept in covered containers while awaiting incineration.
4. Aircraft shall maintain 1,000 foot above ground level (AGL) (except for take off and landings) over designated caribou concentration areas (i.e., winter and summer ranges, insect relief areas, etc.) during the specific time period designated (winter - October 1st through May 15th, summer - May 15th through September 30th) unless doing so would endanger human life or safe flying practices.
5. All operations shall be conducted with due regard for good resource management and in such a manner as not to block any stream, or drainage system, or change the character or course of a stream, or cause the pollution or siltation of any stream or lake.
6. All activities shall be conducted so as to avoid or minimize disturbance to vegetation.
7. Cultural and Paleontological Resources. Any cultural or Paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the AO. An evaluation of the discovery will be made by the AO to determine appropriate actions to prevent the loss of significant cultural or scientific values. The Holder will be responsible for the cost of evaluation and any decision as to the proper mitigation measures will be made by the AO after consulting with the Holder.
8. Crossing of waterway courses shall be made using a low angle approach in order not to disrupt the naturally occurring stream or lake banks.
9. Camps will be situated on gravel bars, sand, or other durable lands. Where leveling of trailers or modules is required and the surface has a vegetative mat, leveling will be accomplished with blocking rather than leveling with a bulldozer.
10. Black water shall be kept separate from gray water and kitchen wastewater. Gray wash water and kitchen wastewater may be filtered to remove solids and the liquid discharged to the land surface. All solids and sludges shall be incinerated.
11. All solid wastes shall be removed from the public lands to Alaska State DEC approved solid waste

disposal facilities. Solid waste combustibles may be incinerated. All non-combustible solid waste, including ash from incineration and fuel drums, shall be removed for approved disposal. There will be no burial of garbage or human wastes.

12. All fuel spills will be cleaned up immediately, taking precedence over all other matters, except the health and safety of personnel. Spills will be cleaned up utilizing absorbent pads or other Alaska State DEC approved methods.
13. As soon as possible, but not later than 24 hours, notice of any such discharge of oil or hazardous substance as defined in AS 46.03.755, 18 AAC 75.300-.307, will be given to the Authorized Officer and any other Federal and State officials as are required by law.
14. DEC approved oil spill cleanup materials (absorbents) will be carried by each field crew and stored at all fueling points and vehicle maintenance areas.
15. State and Federal safety standards for fuel handling will be followed.
16. No fuel storage or refueling of equipment will be allowed within the flood plain of a river or lake.
17. Drip basins or absorbent diapers will be placed under all non dry-disconnect-type fuel line couplings and valves.
18. Fuel and other petroleum products storage of 55 gallons or greater must have secondary containment with 110% of the capacity of the primary storage. The secondary containment, such as lined and bermed systems, must meet local, State and federal codes and regulations. Above ground storage of fuels or other petroleum products in excess of 660 gallons, or an aggregate above ground storage capacity of greater than 1320 gallons; or any facility which, due to location, could reasonably expect spilled fuels to reach waters of the United States or adjoining shorelines must prepare and maintain a Spill Prevention Control and Countermeasure (SPCC) Plan in accordance with 40 CFR 112 regulations.
19. All fuel containers, including barrels and propane tanks, shall be marked with Holder's name, product type, and year filled or purchased (e.g., Company Name, Hydraulic Fluid, 1994).
20. All structures will be painted so as to blend into the natural environment. All colors are to be pre-approved by the Authorized Officer of BLM.
21. All operations must not impede rural residents from pursuing their traditional subsistence activities (ANILCA, PL 96-487).
22. During construction the Holder shall provide a bond in the amount of $__________, to be maintained until restoration of the disturbed areas and other requirements relative to the construction phase of the project have been accepted by the Authorized Officer. Upon completion, or partial completion of these construction related requirements, the AO may terminate or reduce the amount of the bond.
23. During termination, a bond, acceptable to the AO, shall be furnished by the Holder by ____________ or at such earlier date as may be specified by the AO. The amount of this bond shall be determined by the AO. This bond must be maintained in effect until removal of improvements and restoration of the right-of-way / permit have been accepted by the AO.
24. Should the bond delivered under this grant / permit become unsatisfactory to the AO, the Holder, shall, within 30 days of demand, furnish a new bond.
25. The Holder agrees that all monies deposited with the AO as security for Holder's performance of the terms and conditions of this grant / permit may, upon failure on the holder's part to fulfill any of the requirements herein set forth or made a part hereof, be retained by the United States to be applied as far as may be needed to the satisfaction of the Holder's obligations assumed hereunder, without prejudice whatever to any other rights and remedies of the United States.
26. Holder shall comply with all applicable Federal, State and local laws and regulations thereunder, existing or hereafter enacted or promulgated, affecting in any manner, construction, operation, or maintenance of the authorized structures and surrounding lands.
27. The United States reserves the right to use the lands or to authorize the use of the lands in any way compatible with the authorized use. Authorized representatives of Federal and State agencies, and State or local law enforcement personnel shall at all times have the right to enter the premises on official business.
28. This permit/lease does not authorize the cabin(s) or site to be used for a residence or for any purposes not specified on the permit/lease. Any changes must be approved in advance by the authorized officers. The Authorization grants no unspecified privileges, such as exclusive use of a trapping area, etc.
29. No authorized prior existing uses will be interfered with by the holder of the lease/permit, nor will any public access routes, including, but not limited to trails, roads, river, and streams, be blocked or otherwise disturbed.

(For use only with commercial cabins), The Holder shall submit a yearly statement which includes:

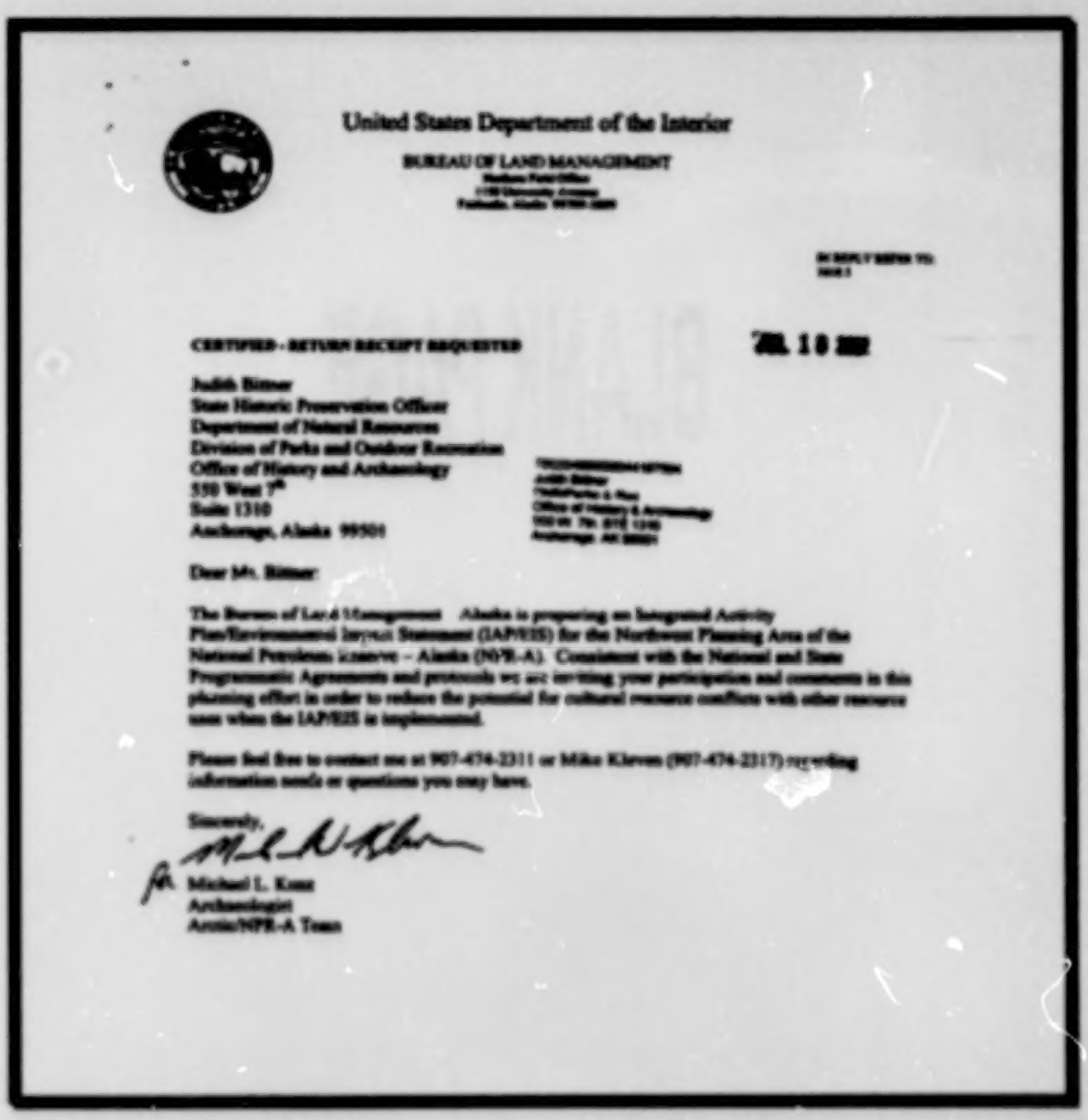
1. period(s) of use;
2. purpose of use; and

revenue generated by use. Copies of receipts indicating gross income shall be submitted yearly. Failure to submit the required statement of use for cabin(s) for a period of two consecutive years will result in a determination that the cabin(s) has been abandoned and the lease/permit will be canceled.

30. Failure to construct during an 18-month period after issuance of the lease/permit will result in a determination that the cabin(s) and/or site has been abandoned and the lease/permit will be canceled.
Commercial Cabins: This lease/permit may be transferred subleased, or rented by the lessee only after receiving written authorization from the authorized officer.
Special Cabin(s): The structure(s) authorized shall not be subleased or rented.
31. Clearing of vegetation is permitted only for the area of the actual construction site and brushing for fire protection, in other areas the vegetation will be left in its natural state.
32. The applicant shall obtain a house log permit or sale for logs used in construction of structures.
33. The applicant shall obtain a firewood cutting permit which shall be limited to dead timber (down or standing).
34. If the Holder discovers any archeological, Paleontological, or historical objects, he shall leave them in place and notify the authorized officer within 30 days of their discovery.
35. The Federal government shall not be held responsible for protection of the Holder's structures or other personal property. Fire protection in the area will be consistent with the approved fire management plan.
36. The Holder shall be liable for damages to public lands resulting from his/her negligent use of fire.
37. Outhouses will be located a minimum of at least 100 feet from the high-water mark of streams, rivers or lakes. Pits will be backfilled with a minimum of two feet of over-material when the pit has reached capacity or the permit/lease is terminated. All outhouses must comply with State DEC Standards.
38. The cabin(s) and surrounding area must be kept clear and litter free. Waste must be burned or incinerated as specified by State law (18AAC (94.260)) and noncombustible waste will be backhauled to an approved solid waste disposal site.
39. Fuel drums will be stored a minimum of 150 feet from any water body.
40. Violation of any of the terms of the lease/permit or associated stipulations shall be considered cause for termination. The cabin lease or permit may be terminated immediately, if necessary to prevent damage to public values or for public safety, if the permit site has not been brought into conformance.
41. Cabin permits and leases will expire upon conveyance of interim managed land to the State or Native Corporation(s), unless an agreement has been reached with the entity receiving title. (This agreement must be reached prior to issuance of the lease.)
42. Upon termination, revocation, or cancellation of a lease or permit, the Holder shall remove all structures and improvements, except those owned by the United States, within 60 days of the notice of termination, revocation, or cancellation, and shall restore the site to as nearly a natural condition as possible, unless otherwise agreed upon in writing or in the use authorization. If the Holder fails to remove all such structures of improvements within the agreed upon time period, the structures or improvements shall become the property of the United States, however, this shall not relieve the holder of liability for the cost of any required removal and restoration of the site.
43. Cancellation of a lease or permit for any reason does not relieve the Holder of the responsibility and liability for cleaning up and rehabilitation the site.
44. Precise geographic positions of all research sites associated with this authorization shall be submitted to the Authorized Officer. These locations can be noted by either Latitude and Longitude or Universal Transverse Mercator coordinates.
45. A summary of the previous field seasons activities shall be submitted to the Authorized Officer by December 31st of each year during the authorized period. The summary shall include the approximate number of times each site was visited, by how many people, and at what time periods. This summary shall also include any changes to the type of collection taking place and any proposed site additions.
46. A copy of published results from the data acquired will be submitted to the Authorized Officer upon Permit expiration or renewal.
47. Protection of Survey Monuments. The Holder shall protect all survey monuments. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coast and Geodetic benchmarks and triangulation

stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the Holder shall immediately report the incident, in writing, to the Authorized Officer and the respective installing agency, if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the Holder shall secure the services of a registered land surveyor or a Bureau Cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of Public Lands of the United States, latest edition. If the Bureau Cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monuments, the Holder shall be responsible for survey costs.

APPENDIX 14. ARCHAEOLOGICAL/CULTURAL RESOURCES CONSULTATION



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

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Judith Bittner
State Historic Preservation Officer
Department of Natural Resources
Division of Parks and Outdoor Recreation
Office of History and Archaeology
550 West 7th
Suite 1310
Anchorage, Alaska 99501

Dear Ms. Bittner:

The Bureau of Land Management – Alaska is preparing an Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the Northwest Planning Area of the National Petroleum Reserve – Alaska (NPR-A). Consistent with the National and State Programmatic Agreements and protocols we are inviting your participation and comments in this planning effort in order to reduce the potential for cultural resource conflicts with other resource uses when the IAP/EIS is implemented.

Please feel free to contact me at 907-474-2311 or Mike Kleven (907-474-2317) regarding information needs or questions you may have.

Sincerely,

fa Michael L. Kunz
Archaeologist
Arctic/NPR-A Team

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APPENDIX 15. Representative Comment Letters on the Draft IAP/EIS

Appendix 15 is located on the CD-ROM included with the Final IAP/EIS and on the website.

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APPENDIX 16. PROPOSED BLM SENSITIVE SPECIES LIST FOR ALASKA

Northern goshawk (Queen Charlotte)	*Accipiter gentilis laingi*
Tule white-fronted goose	*Anser albifrons elgasi*
Marbled murrelet	*Brachyramphus marmoratus*
Dusky Canada goose	*Branta canadensis occidentalis*
Gray-cheeked thrush	*Catharus minimus*
Olive-sided flycatcher	*Contopus cooperi/borealis*
Trumpeter swan	*Cygnus buccinator*
Blackpoll warbler	*Dendroica striata*
Townsend's warbler	*Dendroica townsendi*
American peregrine falcon	*Falco peregrinus anatum*
Arctic peregrine falcon	*Falco peregrinus tundrius*
Harlequin duck	*Histrionicus histrionicus*
Bristle-thighed curlew	*Numenius tahitiensis*
Buff-breasted sandpiper	*Tryngites subruficollis*
Kittlitz's murrelet	*Brachyramphus brevirostris*
King eider	*Somateria spectabilis*
Long-tailed duck	*Clangula hyemalis*
Black scoter	*Melanitta nigra*
Black guillemot	*Cepphus grylle*
Dovkie	*Alle alle*
Red-throated loon	*Gavia stellata*
Brant	*Branta bernicla*
Red knot	*Calidris canutus*
Black-tailed godwit	*Limosa limosa*
Surf scoter	*Melanitta perspicillata*
Mckay's bunting	*Plectrophenax hyperboreus*
Marbled godwit	*Limosa fedoa*
Common eider	*Somateria mollissima*
Yellow-billed loon	*Gavia adamsii*

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[illegible]	
Canada lynx	*Lynx canadensis*
Harbor seal	*Phoca vitulina*
[illegible]	
[illegible]	[illegible]
Angayukaksurak char	*Salvelinus anaktuvukensis*
Western brook lamprey	*Lampetra richardsoni*
Gulkana steelhead	*Oncorhyachus mykiss*
Kigluaik char	*Salvelinus alpinus*
Clear Creek chum salmon	*Onconhynchus keta*
Beaver Creek chinook salmon	*Onconhynchus tshawytscha*
[illegible]	
[illegible]	[illegible]
—	*Artemisia aleutica*
—	*Artemisia globularia var lutea*
—	*Artemisia senjavinensis*
—	*Beckwithia glacialis ssp alaskana*
—	*Botrychium ascendens*
—	*Claytonia ogilviensis*
—	*Cochlearia sessilifolia*
—	*Cryptantha shackletteana*
—	*Douglasia beringensis*
—	*Draba aleutica*
—	*Draba kananaskis*
—	*Draba murrayi*
—	*Draba ogilviensis*
—	*Erigeron muirii*
—	*Eriogonum flavum var aquilinum*
—	*Erysimum asperum var angustatum*
—	*Lesquerella calderi*
—	*Ligusticum calderi*
—	*Mertensia drummondii*
—	*Oxytropis arctica var barnebyana*
—	*Oxytropis kobukensis*
—	*Poa hartzii ssp alaskana*
—	*Podistera yukonensis*
—	*Polystichum aleuticum*
—	*Salix reticulata ssp glabellicarpa*
—	*Saxifraga aleutica*
—	*Senecio moresbiensis*
—	*Smelowskia pyriformis*

Key:

– = Not available

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Table II-01
Land Management Designations:
Potential Wilderness/Special Areas and Wild and Scenic Rivers

Potential Wilderness Study Area (WSA) or Special Area Designation	No WSA or Special Area designations proposed	No WSA or Special Area designations proposed	Kasegaluk Lagoon area proposed for Special Area designation	Kasegaluk Lagoon, Foothills, and Mountain areas proposed for WSA designation	Kasegaluk Lagoon area proposed for Special Area designation
Wild and Scenic Rivers (WSR)	No WSR's recommended	No WSR's recommended	No WSR's recommended	Colville River recommended for wild WSR designation; 21 streams recommended for scenic WSR designation: Alataktok, Alaktak, Avak, Avalik, Chipp, Inaru, Ivisaruk, Kaolak, Ketik, Kigalik, Kuk, Kungok, Meade, Nokotlek, Ongorakvik, Oumalik, Titaluk, Topagoruk, and Tunalik, Usuktuk Rivers, and Maybe Creek	No WSR's recommended

Note:
Portions of the existing Teshekpuk Lake and Colville River Special Areas are in the Planning Area. Their designations are not altered in any alternative.

WSA = Wilderness Study Area.

WSR = Wild and Scenic Rivers.

Table II-01
Land Management Designations (continued)
Visual Resource Management

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Visual Resource Management (VRM) Designations **(See Maps 21-24 for depictions of VRM units for Alternatives A through C)**	None	For an area up to ½ mile from rivers and estuarine areas: VRM II: Colville River VRM III: estuarine and 21 rivers* VRM IV: rest of Planning Area	For an area up to 1 mile from rivers and estuarine areas: VRM II: Avak, Colville, Nokotlek, Ongoravik, and Tunalik Rivers, estuarine area, and Kasegaluk Lagoon Special Area VRM III: 17 Rivers* VRM III-IV: rest of Planning Area	For an area up to 5 miles from rivers and estuarine areas: VRM I: Colville River; and the 3 proposed wilderness areas VRM II: other WSR corridors and estuarine area VRM III: rest of Planning Area	For an area up to 3 miles from rivers and estuarine areas: VRM I: Colville River VRM III: estuarine and 21 rivers* VRM IV: rest of Planning Area

Notes:
Visual Resource Management classes are described in Appendix 3. The extent of VRM objective classes from the rivers and estuarine areas would be less than the above distances where land features limit the viewshed.

VRM = Visual Resource Management.

*Rivers are those recommended for scenic WSR status under Alternative C but not recommended for scenic status under Alternative B.

Table II-01
Land Management Designations (continued)
Travel Management

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1. Off Highway Vehicle (OHV) Designations	The Planning Area would remain Undesignated.	Designated Open to all OHV use throughout the Planning Area.	Designated Limited: a. winter use by snowmachines and other low-ground-pressure vehicles; and	Designated Limited: a. winter use by snowmachines and other low-ground-pressure vehicles (closed to summer use); and	Designated Limited: a. winter use by snowmachines and other low-ground-pressure vehicles; and
			b. summer use of OHV's with ground pressure ≤ 2.2 psi on designated trails only (none in the Kasegaluk Lagoon Special Area).	b. no summer recreational use of motorized vehicles.	b. no summer recreational use of motorized vehicles.
2. Subsistence and Authorized Uses	No restrictions on subsistence use; specific authorizations may stipulate use.	No restrictions on subsistence use; specific authorizations may stipulate use.	Airboat use in summer would be limited to streams, lakes, and estuaries that are seasonally accessible by motorboats; airboat use would be prohibited in seasonally flooded tundra and shallow waters with vegetation adjacent to streams, lakes, and estuaries. Specific authorizations may further stipulate use of airboats and OHV's.	Airboat use in summer would be limited to streams, lakes, and estuaries that are seasonally accessible by motorboats; airboat use would be prohibited in seasonally flooded tundra and shallow waters with wetland vegetation adjacent to streams, lakes, and estuaries. Specific authorizations may further stipulate use of airboats and OHV's.	Airboat use in summer would be limited to streams, lakes, and estuaries that are seasonally accessible by motorboats; airboat use would be prohibited in seasonally flooded tundra and shallow waters with wetland vegetation adjacent to streams, lakes, and estuaries. Specific authorizations may further stipulate use of airboats and OHV's.

Note:
With the exception of airboats, the above restrictions do not apply to boats.
OHV = **Off Highway Vehicle(s)**

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Table II-01
Land Management Designations (continued)
Lands Available for Oil and Gas Leasing; Fire Management

Lands Available for Oil &Gas (O&G) Leasing	None	All federal oil and gas resources in the Planning Area: 100% of BLM subsurface; 100% of high oil and gas potential BLM subsurface.	All federal oil and gas resources in the Planning Area except the Kasegaluk Lagoon Special Area: 96% of BLM subsurface; 100% of high oil and gas potential BLM subsurface.	All federal oil and gas resources in the Planning Area, except in areas associated with important surface resources or under non-federal surface lands: 47% of BLM subsurface <2% of high oil and gas potential BLM subsurface.	All federal oil and gas resources in the Planning Area: 100% of BLM subsurface; 100% of high oil and gas potential BLM subsurface. Leasing would be deferred for 10 years on the 17% of lands that are located in the western part of the Planning Area.
Fire Management (See Appendix 6 for Fire Management Constraints)	None	No constraints. BLM may use management-ignited fires to improve vegetation conditions for specific resources.	No constraints. BLM may use management-ignited fires to improve vegetation conditions for specific resources.	No constraints. BLM may use management-ignited fires to improve vegetation conditions for specific resources.	No constraints. BLM may use management-ignited fires to improve vegetation conditions for specific resources.

Note:
O&G = Oil and Gas

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Table II-02
Stipulations and Required Operating Procedures (ROP's)

A. Waste Prevention, Handling, and Disposal and Spills	**Stipulation A-1.** For oil- and gas-related activities, a Hazardous-Materials Emergency-Contingency Plan shall be prepared and implemented before transportation, storage, or use of fuel. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Sufficient oil-spill-cleanup materials (absorbents, containment devices, etc.) shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment. Procedures applicable to fuel handling (associated with transportation vehicles) may consist of Best Management Practices if approved by the AO. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of Federal, State, and NSB contacts. Other Federal and State regulations may apply and require additional planning requirements. All staff shall be instructed regarding these procedures.		A-3 A-4(a)
	Stipulation A-2. Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO, whether in excess of 660 gallons in a single tank or in excess of 1,320 gallons in multiple containers, shall be stored within an impermeable lined and diked area capable of containing 110 percent of the stored volume. The liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. The storage area shall be located at least 100 ft from the active flood plain of any non-fish bearing waterbody and 500 ft from the active floodplain of any fish-bearing waterbody, with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes and small equipment.	**Stipulation A-2.** Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO—whether in excess of 660 gallons in a single tank or in excess of 1,320 gallons in multiple containers—shall be stored within an impermeable lined and diked area capable of containing 110 percent of the stored volume. The liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. The storage area shall be located at least 500 ft from the active flood plain of any waterbody, with the exception of small caches (up to 210 gallons) for motorboats, float planes, and ski planes.	A-4 (b) (c) (d) II-2

Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	[illegible]	[illegible]	[illegible]
A. Waste Prevention, Handling, and Disposal and Spills (continued)	**Stipulation A-3.** Refueling of equipment within 500 ft of the active flood plain of any fish-bearing waterbody and 100 ft from non-fish-bearing waterbodies is prohibited. The BLM acknowledges that exceptions are commonly warranted for refueling motorboats, float planes, ski planes, small generators, water pumps, and other light equipment used in conjunction with temporary activities.	**Stipulation A-3.** Refueling of equipment within 500 ft of the active flood plain of any waterbody is prohibited, with the exception of refueling motorboats, float planes, ski planes, small generators, water pumps, and other light equipment used in conjunction with temporary activities.	A-5
	ROP A-1. Attracting wildlife to food and garbage is prohibited. All feasible precautions shall be taken to avoid attracting wildlife to food and garbage. A current list of approved precautions, specific to type of permitted use, can be obtained from the AO. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner to prevent the attraction of wildlife.		A-2 (a)
	ROP A-2. Burial of garbage is prohibited. All putrescible waste shall be incinerated or composted in a manner approved by the AO. All solid waste, including incinerator ash, shall be removed from BLM lands and disposed of in an approved waste-disposal facility in accordance with U.S. Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) regulations and procedures. Burial of human waste is prohibited except as authorized by the AO.		A-2 (b)
	ROP A-3. Except as specifically provided, all pumpable solid, liquid, and sludge waste shall be disposed of by injection in accordance with EPA, ADEC, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage will be allowed as necessary to facilitate annular injection and/or backhaul operations.		A-2 (c)
	ROP A-4. Wastewater disposal: a. Unless authorized by the National Pollution Discharge Elimination System (NPDES) or State permit, disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, is prohibited. b. Surface discharge of reserve-pit fluids is prohibited unless authorized by applicable NPDES, ADEC, and NSB permits and approved by the AO. c. Disposal of produced waters in upland areas, including wetlands, will be by subsurface-disposal techniques. The AO may permit alternate disposal methods if the lessee demonstrates that subsurface disposal is not feasible or prudent. d. Discharge of produced waters into open or ice-covered marine waters less than 33 ft (10 m) is prohibited. The AO may approve discharges into waters greater than 33 ft (10 m) deep based on a case-by-case review of environmental factors and consistency with the conditions of an NPDES permit. Alternate disposal methods will require an NPDES permit certified by the State.		A-2 (d) A-6 A-7

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A. Waste Prevention, Handling, and Disposal and Spills (continued)	**ROP A-5.** Areas of operation shall be left clean of all debris.			A-1
	ROP A-6. Operators shall prevent migration of fuel or chemicals from storage areas to the environment. Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the AO as soon as possible, but no later than 24 hours after occurrence. Other Federal, State, and NSB entities shall be notified as required by law. All spills shall be cleaned up immediately and to the satisfaction of the AO and all agencies with regulatory authority over spills, including the EPA, ADEC, and the U.S. Coast Guard.			A-4(f)
	ROP A-7. Before production and as required by law, lessees shall develop spill prevention and response contingency plans.			A-4
	ROP A-8. All fuel containers, including barrels and propane tanks, shall be marked with the responsible party's name, product type, and year filled or purchased.			A-4(e)
B. Ice Roads and Water Use	**Stipulation B-1.** Water withdrawal is not allowed during winter from lakes less than 7 ft (2.1 m) deep unless the water body lacks a connection with, and is not subject to, seasonal flooding by a fish-bearing stream. The AO may authorize water withdrawals from any lakes, creeks, or rivers if the proponent demonstrates that the location and volume of water withdrawal does not endanger resident fish populations.		**Stipulation B-1.** Water withdrawal from rivers and streams during winter is prohibited. Water withdrawal is limited to 15% of the under-ice water volume in any fish-bearing lake. After consultation with the appropriate Federal, State, and NSB regulatory and resource agencies, the AO may authorize withdrawals from any lake if the proponent demonstrates that no fish exist in the lake.	B-1 B-2(a)-(f)

Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. Ice Roads and Water Use (continued)			A water-monitoring plan will be required to assess drawdown and water quality changes before, during, and after pumping any fish-bearing lakes. Ice chips may be removed from lakes and shallow rivers that the proponent demonstrates are not fish bearing and where the ice is grounded.	
			Stipulation B-2. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice-road crossings and water pumping stations on lakes.	B-2(h)
C. Overland Moves and Seismic Work	**Stipulation C-1.** The following restrictions apply to overland moves, seismic work, and any similar use of heavy equipment (other than actual excavations as part of construction) on non-roaded surfaces during the winter season: a. Operators shall consult with the Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NOAA Fisheries, formerly NMFS) before initiating activities in coastal habitat between October 30 and April 15. Activities are prohibited within 1 mile of known or observed polar bear dens. b. Ground operations are to begin only after frost and snow cover have reached sufficient depths to meet the tundra protection objectives of minimizing compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Ground operations shall cease when the spring melt of snow begins, approximately May 5 in the foothills area where elevations exceed 300 ft and approximately May 15 in the northern coastal areas. The exact dates will be determined by the AO.			C-1(b) C-2(a)
	ROP C-1. The following restrictions apply to overland moves, seismic work, and any similar use of heavy equipment (other than actual excavations as part of construction) on non-roaded surfaces during the winter season: a. Snow bridges shall be removed or breached immediately after use or before spring breakup. Ramps and bridges shall be substantially free of soil and/or debris. b. To avoid additional freeze down of deep-water pools harboring over-wintering fish, waterways shall be crossed at shallow riffles from point bar to point bar whenever possible.			C-3 C-4

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

C. Overland Moves and Seismic Work (continued)	c. On-the-ground activities shall use low-ground-pressure vehicles such as Rolligons, ARDCO, Trackmaster, Nodwell, or similar types of vehicles. A current list of approved vehicles can be obtained from the AO. Limited use of tractors equipped with wide tracks or "shoes" will be allowed to pull trailers. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to ice roads or hardened snow trails for use by Rolligons. e. Bulldozing of tundra, trails, or seismic lines is prohibited. Clearing of drifted snow along a trail, seismic line, or in a camp is allowed to the extent that the tundra mat is not disturbed.		C-2(b)-(e)
	f. Motorized ground-vehicle use will be minimized within 1 mile of any raptor nest from April 15 through August 15, with the exception that use will be minimized near gyrfalcon nests beginning March 15. Such use may be prohibited within ½ mile of active raptor nests. g. Refueling of equipment, when practical, should occur at least 500 ft from fish bearing waterbodies and 100 ft from other waterbodies.	**Stipulation C-2.** The following restrictions apply to overland moves, seismic work, and any similar use of heavy equipment (other than actual excavations as part of construction) on non-roaded surfaces during the winter season:	
		a. Motorized ground-vehicle use will be minimized within 1 mile of any raptor nest from April 15 through August 15, with the exception that use will be minimized near gyrfalcon nests beginning March 15. Such use will be prohibited within ½ mile of known raptor-nesting sites.	**(Note: C-2a removed from the Preferred Alternative--not relevant to winter operations)**
		b. Refueling of equipment is prohibited within the active floodplain of any waterbody.	**A-5**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

Activity	Alternative A	Alternative B	Alternative C	Preferred Alternative (Table [illegible])
D. Oil and Gas Exploratory Drilling	**Stipulation D-1.** Exploratory drilling in shallow lakes, streams, lake beds and the active floodplain will only be approved if the applicant can demonstrate to the satisfaction of the AO that impacts to fish, wildlife, vegetation, and the hydrologic condition are minimal.		**Stipulation D-1.** Exploratory drilling in river, stream, and lakebeds, as determined by the active floodplain, is prohibited. In addition, exploratory drilling is not allowed within ¼ mile of any fish-bearing deep lake as determined to be in lake zone III, i.e., depth greater than 4 m (Mellor 1985) as shown in Map 20. If the fish-bearing status of the waterbody is unknown, the burden is on the lessee to demonstrate whether fish are absent.	D-1
			Stipulation D-2. Permanent facilities such as airstrips and roads shall not be constructed during the exploration phase of oil and gas development.	D-2
E. Facility Design and Construction		**Stipulation E-1.** The following subsistence, wildlife habitat, cultural/paleontological, and traditional/cultural land use areas are of significant concern to resource managers and local communities. (Resources of concern are listed in parentheses on the following pages.) Should significant resources occur within these land use areas based on site specific investigation, additional design features or mitigation developed through site/project specific NEPA analysis will be required to minimize impacts. As listed on the following pages, setbacks include the bed of waterbodies and are measured from the active floodplain.	**Stipulation E-1.** Permanent oil and gas facilities, including roads, airstrips, and pipelines are prohibited within and adjacent to the waterbodies and within the prescribed distances from other resources listed below (see Map 84) at the distances identified to protect fish and raptor habitat, cultural and paleontological resources, and subsistence and other resource values. (Resources of concern are listed in parentheses on the following pages.) Setbacks include the bed of the waterbody and are measured from the active floodplain. On a case-by-case basis, and in consultation with appropriate Federal, State, and NSB regulatory and	**K-1 as noted below**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

Activity	Alternative A	Alternative B	Alternative C	[illegible]
E. Facility Design and Construction (continued)		**Stipulation E-1.** (continued) a. Ikpikpuk River: extending from the mouth south through the raptor nesting area extending from section 13, T7N., R12W. UM, to T2N., R 12W., UM where up to a 1-mile setback may be required (fish, raptors, subsistence, cultural, and paleontological resources). b. Alaktak River: up to ½-mile setbacks extending from the mouth to the Ikpikpuk River (fish and subsistence resources). c. Chipp River: up to ½-mile setbacks extending from the mouth to the Ikpikpuk River (fish and subsistence resources). d. Oumalik River: up to ½-mile setbacks downstream from section 11, T5N., R15W.,UM (fish and subsistence resources). e. Titaluk River; up to ½-mile setbacks downstream from section 30, T2N., R16W.,UM (fish and subsistence resources). f. Kigalik River: up to ½-mile setbacks (riparian, cultural, and paleontological resources). g. Maybe Creek: up to ½-mile setbacks (riparian, cultural, and paleontological resources). h. Topagoruk River: up to ½-mile setbacks downstream from the confluence with Ishuktak Creek (fish and subsistence resources).	**Stipulation E-1.** (continued) resource agencies, essential pipeline and road crossings will be permitted through setback areas in those instances where no other suitable sites are available. Stream crossings will be sited perpendicular to the main channel flow; lake crossings will be at the narrowest point. Road crossings are prohibited in the setback area adjacent to the Colville River (see items below). a. Ikpikpuk River: a 1/2-mile setback from the bank of the Ikpikpuk River extending from the mouth south to the Raptor nesting area extending from section 13, T7N., R12W. UM, to T2N., R 12W., UM where a 1-mile setback is required (fish, raptors, subsistence, cultural, and paleontological resources). b. Alaktak River: a ½-mile setback from each bank of the Alaktak River extending from the mouth to the Ikpikpuk River (fish and subsistence resources). c. Chipp River: a ½-mile setback from each bank of the Chipp River extending from the mouth to the Ikpikpuk River (fish and subsistence resources). d. Oumalik River: a ½-mile setback from each bank of the Oumalik River downstream from section 11, T5N., R15W.,UM (fish and subsistence resources).	K-1(b) K-1(c) K-1(d) K-1(e)

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Stipulation E-1. (continued)	**Stipulation E-1.** (continued)	
E. Facility Design and Construction (continued)		i. Meade River: up to ½-mile setbacks downstream from section 7, T2N., R23W.,UM (fish, subsistence, cultural and paleontological resources).	e. Titaluk River: a ½-mile setback from each bank of the Titaluk River downstream from section 30, T2N., R16W.,UM (fish and subsistence resources).	**K-1(f)**
		j. Inaru River: up to ½-mile setbacks downstream from the confluence with Kucheak Creek (fish and subsistence resources).	f. Kigalik River: a ½-mile setback from each bank of the Kigalik River (riparian, cultural, and paleontological resources).	**K-1(g)**
		k. Kugrua River: up to ½-mile setbacks downstream from section 18, T15N., R27W.,UM (fish and subsistence resources).	g. Maybe Creek: a ½-mile setback from each bank of the Maybe (riparian, cultural and paleontological resources)	**K-1(h)**
		l. Kuk River: up to ½-mile setbacks (fish, subsistence, cultural and paleontological resources). m. Alataktok River: up to ½-mile setbacks downstream from section 3, T5N., R16W.,UM (fish and subsistence resources).	h. Topagoruk River: a ½-mile setback from each bank of the Topagoruk River downstream from the confluence with Ishuktak Creek (fish and subsistence resources).	**K-1(i)**
		n. Ivisaruk River: up to ½-mile setbacks downstream from section 24, T10N., R34W.,UM (fish and subsistence resources).	i. Meade River: a ½-mile setback from each bank of the Meade River downstream from section 7, T2N., R23W.,UM (fish, subsistence, cultural and paleontological resources).	**K-1(k)**
		o. Kaolak River: up to ½-mile setbacks downstream from section 35, T9N., R31W.,UM (fish and subsistence resources). p. Ketik River: up to ½-mile setbacks downstream from section 32, T9N., R31W.,UM (fish and subsistence resources).	j. Inaru River: a ½-mile setback from each bank of the Inaru River downstream from the confluence with Kucheak Creek (fish and subsistence resources).	**K-1(o)**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

E. Facility Design and Construction (continued)		**Stipulation E-1.** (continued) q. Avalik River: up to ½-mile setbacks downstream from section 31, T9N., R28W.,UM (fish and subsistence resources). r. Kungok River: up to ½-mile setbacks downstream from section 35, T9N., R31W.,UM (fish and subsistence resources). s. Colville River: up to 2-mile setbacks from the northern bluff (or bank if there is no bluff) of the Colville River extending the length of that portion of the river within the Planning Area and identified as raptor nesting and foraging habitat. (raptor, fish, riparian, paleontological, subsistence, scenic, and recreational resources). t. Deep-water lakes: up to ½-mile setbacks around any fish-bearing deep lake as determined to be in lake zone III, i.e., depth > 4m (Mellor 1985). If the fish-bearing status of the waterbody is unknown, the burden would be on the lessee to demonstrate whether fish are present (fish and subsistence resources). u. Waterfowl nesting and brood-rearing areas: up to ½-mile setbacks from identified nesting colonies, nest sites, brood rearing areas, or molting areas (waterfowl habitat).	**Stipulation E-1.** (continued) k. Kugrua River: a ½-mile setback from each bank of the Kugrua River downstream from section 18, T15N., R27W.,UM (fish and subsistence resources). l. Kuk River: a ½-mile setback from each bank of the Kuk River (fish, subsistence, cultural and paleontological resources). m. Alataktok River: a ½-mile setback from each bank of the Alataktok River downstream from section 3, T5N., R16W.,UM (fish and subsistence resources). n. Ivisaruk River: a ½-mile setback from each bank of the Ivisaruk River downstream from section 24, T10N., R34W.,UM (fish and subsistence resources). o. Kaolak River: a ½-mile setback from each bank of the Kaolak River downstream from section 35, T9N., R31W.,UM (fish and subsistence resources). p. Ketik River: a ½-mile setback from each bank of the Ketik River downstream from section 32, T9N., R31W.,UM (fish and subsistence resources). q. Avalik River: a ½-mile setback from each bank of the Avalik River downstream from section 31, T9N., R28W.,UM (fish and subsistence resources).	**In deferral area (IDA)** **IDA** **IDA** **IDA** **IDA** **IDA** **K-1(q)**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	Alternative A	[illegible]	[illegible]	[illegible]
E. Facility Design and Construction (continued)		**Stipulation E-1.** (continued) v. Bays and Lagoons: up to ½-mile setbacks along Kasegaluk Lagoon, Kuk River, and Peard Bay, and coastal waters within Northwest NPR-A east of Barrow, including Elson Lagoon, Dease Inlet, and Admiralty Bay. (Note: Kasegaluk Lagoon is unavailable for leasing under this alternative).	**Stipulation E-1.** (continued) r. Kungok River: a ½-mile setback from each bank of the Kungok River downstream from section 35, T9N., R31W.,UM (fish and subsistence resources). s. Colville River: a 2-mile setback from the northern bluff (or bank if there is no bluff) of the Colville River extending the length of that potion of the river within the Planning Area and identified as raptor nesting and foraging habitat (raptor, fish, riparian, paleontological, subsistence, scenic, and recreational resources). t. Deep-water lakes: a ½-mile setback around the perimeter of any fish-bearing deep lake as determined to be in lake zone III, i.e., depth > 4m (Mellor 1985). If the fish-bearing status of the waterbody is unknown, the burden is on the lessee to demonstrate whether fish are present. u. Waterfowl nesting and brood-rearing areas: ½-mile setbacks from identified nesting colonies, nest sites, brood-rearing areas or molting areas.	IDA K-1(a) K-7 K-2 K-4

Table II-02. **Stipulations and Required Operating Procedures (ROP's)** (continued)

Activity	Alternative A	Alternative B	Alternative C	Preferred Alternative (Table II-03)
E. Facility Design and Construction (continued)			**Stipulation E-1.** (continued) v. Bays and Lagoons: ½-mile setbacks along Kasegaluk Lagoon, Kuk River, and Peard Bay, and coastal waters within NPR-A east of Barrow, including Elson Lagoon, Dease Inlet, and Admiralty Bay. (Note: Kasegaluk Lagoon would be unavailable for leasing under this alternative).	K-3 K-6 K-8 and IDA
			Stipulation E-2. Permanent roads (i.e. gravel, sand) connecting to a road system or docks outside the Planning Area are prohibited. Permanent roads necessary to connect pads within independent, remote oil fields are allowed but they must be designed and constructed to create minimal environmental impacts. Roads connecting production sites between separate oil fields may be considered.	E-1
	ROP E-1. All crude oil, produced water, seawater, and natural gas pipelines shall be designed, constructed, and operated under an approved Quality Assurance/Quality Control plan.			E-4

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

E. Facility Design and Construction (continued)	**ROP E-2.** The lessee shall minimize the development footprint.		**E-5**
	ROP E-3. Bridges, rather than culverts, shall be used for any allowed road crossings on all rivers identified by the AO to reduce the potential of ice-jam flooding and erosion. When necessary on smaller streams, culverts shall be large enough to avoid restricting fish passage or adversely affecting natural stream flow.		**E-6**
	ROP E-4. Design, locate, construct, and operate permanent oil and gas infrastructure to minimize adverse effects on caribou movement.		**E-7(a)-(c)**
	ROP E-5. Pipelines and roads shall be designed to facilitate caribou and subsistence user passage.	**ROP E-5.** Aboveground pipelines shall be elevated at least 5 ft, as measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage and subsistence passage and access. Lessees shall separate elevated pipelines from roads by a minimum of 500 ft, if feasible. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipe and road converge on a drill pad.	**E-7(a) (b) (c)**

Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

E. Facility Design and Construction (continued)	**ROP E-6.** Permanent oil and gas facilities upon or within 500 ft of shallow lakes, streams, lake beds, estuaries, and their active floodplain will only be approved if the applicant can demonstrate to the satisfaction of the AO that adverse impacts to fish, wildlife, vegetation, and the hydrologic condition are minimal. Essential pipeline and road crossings will be permitted on a case-by-case basis.	**Stipulation E-3.** For those waterbodies not listed in stipulation E-1, permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 ft as measured from the active floodplain. Essential pipeline and road crossings will be permitted on a case-by-case basis.	E-2
	ROP E-7. Gravel mine site reclamation will be in accordance with a plan approved by the AO.	**Stipulation E-4.** Gravel mine sites are prohibited within the active floodplain of a river, stream, or lake. Gravel mine site reclamation will be in accordance with a plan approved by the AO.	E-8
	ROP E-8. Coastal facilities shall be designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water-quality characteristics (e.g., salinity, temperature, suspended sediments) that result in measurements exceeding water-quality criteria, and must maintain free passage of marine and anadromous fish.	**Stipulation E-5.** Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas, except as provided in the paragraphs below.	E-3

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	Alternative A	Alternative B	Alternative C	[illegible]
			Approved causeways docks, artificial gravel islands, and bottom-founded structures, shall be designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water-quality characteristics (e.g., salinity, temperature, suspended sediments) that result in measurements exceeding water-quality criteria, and must maintain free passage of marine and anadromous fish. A monitoring program will be required to address the objectives of water quality and free passage of fish. Additional mitigation shall be required where significant deviation from these objectives occurs.	
F. Air Traffic*	**ROP F-1.** All aircraft use shall be conducted in a manner that will minimize impacts to wildlife and birds.		**ROP F-1.** Aircraft shall maintain an altitude of at least 1,500 ft AGL when within ½ mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within ½ mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from BLM necessary to plan flight routes when routes may go near falcon nests.	**F-1(a)**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

Activity	Alternative A	Alternative B	Alternative C	[illegible]
F. Air Traffic* (continued)			**Stipulation F-1.** Aircraft shall maintain an altitude of at least 1,000 ft above ground level (AGL) (except for takeoffs and landings) over caribou winter ranges from October 1 through May 15.	**F-1(b)**
			Stipulation F-2. Aircraft shall maintain an altitude of at least 2,000 ft AGL over the caribou insect relief area from June 20 through July 31, unless doing so would endanger human life or violate safe flying practices.	**F-1(e) (f)**
Note: *The BLM's authority to restrict air traffic is limited to those activities associated with use authorization on BLM-administered lands.				
G. Oil Field Abandonment	**Stipulation G-1.** Upon field abandonment or expiration of a lease or oil- and gas-related permit, all facilities shall be removed and sites rehabilitated to the satisfaction of the AO after determining whether it is in the best interest of the public to retain some or all of the facilities.			**G-1**
H. Subsistence	**Stipulation H-1.** All operations shall be conducted in a manner that prevents unreasonable conflicts with subsistence activities. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, NSB, and the Subsistence Advisory Panel to discuss the siting, timing and methods of proposed operations. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. The applicant shall submit documentation of consultation efforts and a written plan that shows how the applicant's activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. In the event that no agreement is reached between the parties, the AO shall consult with the directly involved parties and determine which activities will occur, including the timeframes.			**H-1** **H-2**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

H. Subsistence (continued)	**ROP H-1.** During exploration, development, and production the lessee shall develop and implement a plan, approved by the AO in consultation with the Research and Monitoring Team and the Subsistence Advisory Panel, to monitor the effects of activities on subsistence. The lessee shall provide biannual reports to BLM, the Research and Monitoring Team, and the Subsistence Advisory Panel.	**H-1(c)(7)**
I. Orientation Program	**ROP I-1.** The lessee shall include in any application for permit to drill a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of lessee's agents, contractors, and subcontractors) for review and approval by the AO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the Planning Area. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. Guidance shall include the production and distribution of information cards on endangered and/or threatened species in the Planning Area. The program shall be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. The program shall be attended at least once a year by all personnel involved in on-site exploration or development and production activities (including personnel of lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors. Individual training is transferable from one facility to another except for elements of the training specific to a particular site. Lessees shall maintain a record onsite of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee.	**I-1**

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
J. Miscellaneous Activities	**Stipulation J-1.** If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as practical and feasible, but consistent with the following: alteration of limited, high quality habitat that could significantly reduce prey availability shall be minimized. Of particular concern are ponds, lakes, wetlands, and riparian habitats.		**Stipulation J-1.** If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as feasible, but consistent with the following: within 15 miles of nest sites, alteration of limited, high quality habitat that could significantly reduce prey availability shall be prohibited. Of particular concern are ponds, lakes, wetlands and riparian habitats.	K-7
			Stipulation J-2. Petroleum exploration and production activities are prohibited within ½ mile of occupied grizzly bear dens, identified by the ADF&G, unless alternative mitigation measures are approved by the AO in consultation with appropriate Federal, State, and NSB regulatory and resource agencies.	C-1(a)
	ROP J-1. Oil and gas lessees and their contractors and subcontractors will prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: (a) minimize attraction of bears to the drill sites; (b) organize layout of buildings and work areas to minimize human/bear interactions; (c) warn personnel of bears near or on drill sites and identify proper procedures to be followed; (d) if authorized, deter bears from the drill site; (e) provide contingencies in the event bears do not leave the site or cannot be deterred by authorized personnel; (f) discuss proper storage and disposal of materials that may be toxic to bears; and (g) provide a systematic record of bears on the site and in the immediate area. Lessees shall develop educational programs and camp layout and management plans as they prepare their lease operations plans.			A-8(a)-(g)

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Table II-02. Stipulations and Required Operating Procedures (ROP's) (continued)

New Stipulations and Required Operating Procedures (i.e., not in Draft IAP/EIS under any Alternative)		
Endangered Species Act-Section 7 Consultation	**Stipulation K.** The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation.	**L**
Various Activities	No corresponding stipulations or required operating procedures for Alternative A, B, or C.	**B-2 (g)** **E-9** **E-10** **E-11** **E-12** **F-1(c) and (d)** **K-1(j)** **K-1(l)** **K-1(m)** **K-1(n)** **K-1(p)** **K-5**

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Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative

[illegible]	[illegible]
A. Waste Prevention, Handling, Disposal; Spills, and Public Safety	**A-1 Required Operating Procedure** **Objective:** Protect the health and safety of oil field workers and the general public by avoiding the disposal of solid waste and garbage near areas of human activity. **Requirement/Standard:** Areas of operation shall be left clean of all debris.
	A-2 Required Operating Procedure **Objective:** Minimize impacts on the environment from non-hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil field workers and the general public. Avoid human-caused changes in predator populations. **Requirement/Standard:** Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the AO for approval, in consultation with Federal, State and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. The plan shall consider and take into account the following requirements: **a) Methods to avoid attracting wildlife to food and garbage:** All feasible precautions shall be taken to avoid attracting wildlife to food and garbage. (A current list of approved precautions, specific to type of permitted use, can be obtained from the AO.) **b) Disposal of putrescible waste:** Current requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the AO. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with U.S. Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) regulations and procedures. The burial of human waste is prohibited except as authorized by the AO. **c) Disposal of pumpable waste products:** Except as specifically provided, BLM currently requires all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, ADEC, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by ADEC, will be allowed as necessary to facilitate annular injection and/or backhaul operations. **d) Disposal of wastewater and domestic wastewater:** BLM currently prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by the National Pollution Discharge Elimination System (NPDES) or State permit.

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Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

[illegible]	Stipulations and Required Operating Procedures for the Preferred Alternative
A. Waste Prevention, Handling, Disposal; Spills, and Public Safety (continued)	**A-3 Required Operating Procedure** **Objective:** Minimize pollution through effective hazardous-materials contingency planning. **Requirement/Standard:** For oil- and gas-related activities, a Hazardous-Materials Emergency-Contingency Plan shall be prepared and implemented before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Procedures applicable to fuel and hazardous substances handling (associated with transportation vehicles) may consist of Best Management Practices if approved by the AO. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of Federal, State, and NSB contacts. Other Federal and State regulations may apply and require additional planning requirements. All staff shall be instructed regarding these procedures.
	A-4 Required Operating Procedure **Objective:** Minimize the impact of contaminants on fish, wildlife, and the environment, including wetlands, marshes and marine waters, as a result of fuel, crude oil and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety. **Requirement/Standard:** Before initiating any oil and gas or related activity or operation, including field research/surveys and/or seismic operations, lessees/permittees shall develop a comprehensive spill prevention and response contingency plan per 40 CFR 112 (OPA). The plan shall consider and take into account the following requirements: **a) On-site clean-up materials.** Sufficient oil-spill-cleanup materials (absorbents, containment devices, etc.) shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment. **b) Storage Containers.** Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the AO in excess of 1,320 gallons in storage capacity, shall be stored within an impermeable lined and diked area or within approved alternate storage containers such as overpacks, capable of containing 110 percent of the stored volume. **c) Liner Materials.** Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. **d) Permanent Fueling Stations.** Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. **e) Proper Identification of Containers.** All fuel containers, including barrels and propane tanks, shall be marked with the responsible party's name, product type, and year filled or purchased. **f) Notice of Reportable Spills.** Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the AO as soon as possible, but no later than 24 hours after occurrence.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

A. Waste Prevention, Handling, Disposal; Spills, and Public Safety (continued)	**A-5 Required Operating Procedure** **Objective:** Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment. **Requirement/Standard:** Refueling of equipment within 500 ft of the active flood plain of any fish-bearing water body and 100 ft from non-fish-bearing water bodies is prohibited. Small caches (up to 210 gallons) for motorboats float planes, ski planes, and small equipment, e.g. portable generators and water pumps, will be permitted. The AO may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.
	A-6 Required Operating Procedure **Objective:** Minimize the impact on fish, wildlife, and the environment from contaminants associated with the exploratory drilling process. **Standard/Requirement:** Surface discharge of reserve-pit fluids is prohibited unless authorized by applicable NPDES, ADEC, and NSB permits (as appropriate) and approved by the AO.
	A-7 Required Operating Procedure **Objective:** Minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment. **Requirement/Standard**: Procedures for the disposal of produced fluids shall meet the following requirements: a) In upland areas, including wetlands, disposal will be by subsurface-disposal techniques. The AO may permit alternate disposal methods if the lessee demonstrates that subsurface disposal is not feasible or prudent and the alternative method will not result in adverse environmental effects. b) In marine waters, approval of discharges by the AO will be based on a case-by-case review of environmental factors and consistency with the conditions of an NPDES permit. Discharge of produced fluids will be prohibited at locations where currents and water depths, in combination with other conditions, are not adequate to prevent impacts to known biologically sensitive areas. Alternate disposal methods will require an NPDES permit certified by the State.
	A-8 Required Operating Procedure **Objective:** Minimize conflicts resulting from interaction between humans and bears during leasing and associated activities. **Requirement/Standard:** Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a) Minimize attraction of bears to the drill sites. b) Organize layout of buildings and work areas to minimize human/bear interactions. c) Warn personnel of bears near or on drill sites and identify proper procedures to be followed. d) Establish procedures, if authorized, to deter bears from the drill site. e) Provide contingencies in the event bears do not leave the site or cannot be deterred by authorized personnel. f) Discuss proper storage and disposal of materials that may be toxic to bears. g) Provide a systematic record of bears on the site and in the immediate area.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	[illegible]
B. Water Use for Permitted Activities	**B-1 Required Operating Procedure** **Objective:** Maintain populations of, and adequate habitat for, fish and invertebrates. **Requirement/Standard:** Water withdrawal from rivers and streams during winter is prohibited.
	B-2 Required Operating Procedure **Objective:** Maintain natural hydrologic regimes in soils surrounding lakes and ponds and maintain populations of, and adequate habitat for, fish and invertebrates. **Requirement/Standard:** Water withdrawal from lakes may be authorized on a site-specific basis depending on size, water volume, depth and fish population and species diversification. Current water withdrawal requirements specify: a) Water withdrawals from any fish bearing lake 7 ft or deeper shall be limited to 15 percent of the estimated free water volume located beneath the ice. b) Water withdrawals from lakes with depths between 5 and 7 ft that contain only ninespine stickleback and/or Alaska blackfish are limited to up to 30 percent of the under-ice volume. c) Water withdrawal may be authorized from any lake if the proponent demonstrates that no fish exist in the lake. d) A water-monitoring plan may be required to assess draw down and water quality changes before, during, and after pumping any fish-bearing lake. e) The removal of naturally grounded ice may be authorized from lakes and shallow rivers on a site-specific basis depending upon its size, water volume, depth, and fish population and species diversification. f) Removed ice aggregate shall be included in the 15 percent or 30 percent (whichever is the appropriate case) withdrawal limits, unless otherwise approved. g) Any water intake structures in fish-bearing waters shall be designed, operated and maintained to prevent fish entrapment, entrainment, or injury. h) Compaction of snow cover or snow removal from fish-bearing water bodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes or areas of grounded ice.
C. Winter Overland Moves and Seismic Work	The following stipulations and ROP's apply to overland moves, seismic work, and any similar cross-country vehicle use of heavy equipment on non-roaded surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.
	C-1 Required Operating Procedure **Objective:** Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations. **Requirement/Standard:** a) Cross-country use of heavy equipment and seismic activities are prohibited within ½ mi of occupied grizzly bear dens identified by ADF&G unless alternative mitigation measures are approved by the AO in consultation with ADF&G. b) Cross-country use of heavy equipment and seismic activities are prohibited within 1 mi of known or observed polar bear dens or seal birthing lairs. Operators shall consult with the U.S. Fish and Wildlife Service (FWS) and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	[illegible]
Overland Moves and Seismic Work (continued)	**C-2 Required Operating Procedure** **Objective:** Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation. **Requirement/Standard:** a) Ground operations shall be allowed only when frost and snow covers are at sufficient depths to protect the tundra. Ground operations shall cease when the spring snowmelt begins, approximately May 5 in the foothills area where elevations reach or exceed 500 ft, and approximately May 15 in the northern coastal areas. The exact dates will be determined by the AO. b) Only low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. A current list of approved vehicles can be obtained from the AO. Limited use of tractors equipped with wide tracks or "shoes" will be allowed to pull trailers, sleighs, or other equipment with approved undercarriage. Note: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction. c) Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed. d) To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons. e) The location of winter ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.
	C-3 Required Operating Procedure **Objective:** Maintain natural spring runoff patterns, avoid flooding, prevent streambed sedimentation, protect water quality and protect stream banks. **Requirement/Standard:** Snow and ice bridges shall be removed, breached or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.
	C-4 Required Operating Procedure **Objective:** Avoid additional freeze down of deep-water pools harboring over-wintering fish and invertebrates used by fish. **Requirement/Standard:** Rivers and streams shall be crossed at shallow riffles from point bar to point bar whenever possible.
D. Oil and Gas Exploratory Drilling	**D-1 Lease Stipulation** **Objectives:** Protect fish-bearing rivers, streams and lakes from blowouts, and minimize alteration of riparian habitat. **Requirement/Standard:** Exploratory drilling is prohibited in rivers and streams, as determined by the active floodplain, and fish-bearing lakes, except where the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

D. Oil and Gas Exploratory Drilling (continued)	**D-2 Lease Stipulation** **Objective:** Minimize surface impacts from exploratory drilling. **Requirement/Standard:** Exploratory drilling shall be limited to temporary facilities such as ice pads, ice roads, ice airstrips, temporary platforms, etc., unless the lessee demonstrates that construction of permanent facilities such as gravel airstrips, storage pads, and connecting roads is environmentally preferable or necessary to carry out exploration more economically.
E. Facility Design and Construction	**E-1 Required Operating Procedure** **Objective:** Protect subsistence use and access to traditional subsistence hunting and fishing areas, and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources. **Requirement/Standard:** All roads must be designed, constructed, maintained and operated to create minimal environmental impacts and to protect subsistence use and access to traditional subsistence hunting and fishing areas. Subject to approval by the AO, the construction, operation and maintenance of oil field roads is the responsibility of the lessee. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes. This preserves the opportunity to plan, design and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within NPR-A.
	E-2 Lease Stipulation **Objective:** Protect fish-bearing water bodies, water quality and aquatic habitats. **Requirement/Standard:** The design and location of permanent oil and gas facilities within 500 ft of fish-bearing or 100 ft of non-fish-bearing waterbodies will only be approved on a case-by-case basis if the lessee can demonstrate that impacts to fish, water quality, and aquatic and riperian habitats are minimal. (Note: Also refer to Area-Specific Stipulations and ROP's for Rivers (Stipulation K-1) and Deep Water Lakes (Stipulation K-2).)
	E-3 Lease Stipulation **Objective:** Maintain free passage of marine and anadromous fish, and protect subsistence use and access to traditional subsistence hunting and fishing. **Requirement/Standard:** Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program may be required to address the objectives of water quality and free passage of fish.
	E-4 Required Operating Procedure **Objective:** Minimize the potential for pipeline leaks, the resulting environmental damage and industrial accidents. **Requirement/Standard:** All pipelines shall be designed, constructed, and operated under an AO-approved Quality Assurance/Quality Control plan that is specific to the product transported.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
E. Facility Design and Construction (continued)	**E-5 Required Operating Procedure** **Objective:** Minimize impacts of the development footprint. **Requirement/Standard:** Facilities shall be designed and located to minimize development footprint to the maximum extent practicable considering environmental, economic, and social impacts. Note: Where aircraft traffic is an issue, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.
	E-6 Required Operating Procedure **Objective:** Reduce the potential for ice-jam flooding, erosion, and restriction of fish passage. **Requirement/Standard:** Water crossings shall be designed and constructed to ensure free passage of fish, maintain natural drainage, and minimal adverse effects to natural stream flow. Note: Bridges, rather than culverts, are the preferred structures for crossing rivers. When necessary, culverts can be constructed on smaller streams, if they are large enough to avoid restricting fish passage or adversely affecting natural stream flow.
	E-7 Required Operating Procedure **Objective:** Minimize disruption of caribou movement and subsistence use. **Requirement/Standard:** Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in traditional subsistence activities. Listed below are the currently accepted design practices: a) Above ground pipelines shall be elevated an average of at least 7 ft as measured from the ground to the bottom of the pipeline (except where pipelines intersect a road, pad, in transition zones between buried and elevated pipelines, or at ramps installed to facilitate wildlife passage and subsistence passage and access). b) In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the AO after consultation with Federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility). c) A minimum distance of 500 ft between pipelines and roads should be maintained when feasible. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad.
	E-8 Required Operating Procedure **Objective:** Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. **Requirement/Standard:** Gravel mine site design and reclamation will be in accordance with a plan approved by the AO. The plan shall consider: a) Locations outside the active flood plain. b) Design and construction of gravel mine sites within active flood plains to serve as water reservoirs for future use. c) Potential use of site for enhancing fish and wildlife habitat.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
E. Facility Design and Construction (continued)	**E-9 Required Operating Procedure** **Objective**: Avoidance of human-caused increases in populations of predators of ground nesting birds. **Requirement/Standard**: Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the AO with an annual report on the use of oil and gas facilities by ravens, raptors and foxes as nesting, denning, and shelter sites.
	E-10 Required Operating Procedure **Objective:** Prevention of migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions. **Requirement/Standard:** Except for safety lighting, illumination of higher structures shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward. All drilling structures, production facilities, and other structures that exceed 20 ft shall be illuminated as outlined above.
	E-11 Required Operating Procedure **Objective**: Minimize the take of species listed under the Endangered Species Act and minimize the disturbance of other species of interest from direct or indirect interaction with oil and gas facilities. **Requirement/Standard:** In accordance with the guidance below, before the approval of facility construction, aerial surveys of breeding pairs of the following species shall be conducted within any area proposed for development. **Spectacled and/or Steller's Eiders** a) Surveys shall be conducted by the lessee for at least three (3) years before authorization of construction, if such construction is within the FWS North Slope Eider survey area (Map 62), and at least one (1) year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol during the second week of June. b) If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall consult with the FWS and BLM in the design and placement of roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, construction of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and introduction of high noise levels. c) To reduce the possibility of spectacled and/or Steller's eiders from striking above-ground utility lines (power and communication), such lines shall either be buried in access roads, or suspended on vertical support members, to the extend practical. Support wires associated with communication towers, radio antennas, and other similar facilities, shall be clearly marked along their entire length to improve visibility for low flying birds. Such markings shall be jointly developed through consultation with FWS.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	**Stipulations and Required Operating Procedures for the Preferred Alternative**
E. Facility Design and Construction (continued)	**E-11 Required Operating Procedure** (continued) **Yellow-billed Loon** a) Aerial surveys shall be conducted by the lessee for at least 3 years before authorization of construction of facilities proposed for development that are within 1 mi of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August. b) Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. Current accepted mitigation is a one-mile buffer around all recorded nest sites and a minimum 500-m buffer around the remainder of the lake shoreline. Development may be prohibited within buffers or activities curtailed while birds are present.
	E-12 Required Operating Procedure **Objective:** Use of ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development. **Requirement/Standard:** An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface-form and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analyses of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the AO, before approval of exact facility location and facility construction.
F. Use of Aircraft for Permitted Activities	**F-1 Required Operating Procedure** **Objective:** Minimize the effects of low-flying aircraft on wildlife, traditional subsistence activities, and local communities. **Requirement/Standard:** The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines: a) Aircraft shall maintain an altitude of at least 1,500 ft above ground level (AGL) when within ½ mi of cliffs identified as raptor nesting sites from April 15 through August 15 and within ½ mi of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from BLM necessary to plan flight routes when routes may go near falcon nests. b) Aircraft shall maintain an altitude of at least 1,000 ft AGL (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the AO. c) The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered so as to allow larger aircraft to be employed, resulting in a fewer number of flights to the facility. d) Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum. e) Aircraft used for permitted activities shall maintain an altitude of at least 2,000 ft AGL (except for takeoffs and landings) over the Caribou Study Area (Map 91) from June 15 through July 31, unless doing so would endanger human life or violate safe flying practices.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

[illegible]	[illegible]
F. Use of Aircraft for Permitted Activities (continued)	**F-1 Required Operating Procedure (Continued)** f) Aircraft shall maintain an altitude of at least 2,000 ft AGL (except for takeoffs and landings) over the Caribou Coastal Insect-Relief Areas (Map 91) from June 15 through July 31, unless doing so would endanger human life or violate safe flying practices.
G. Oil Field Abandonment	**G-1 Lease Stipulation** **Objective:** Ensure the final disposition of the land meets the current and future needs of the public. **Requirement/Standard:** Upon abandonment or expiration of the lease, all oil- and gas-related facilities shall be removed and sites rehabilitated to as near the original condition as practicable, subject to the review of the AO. The AO may determine that it is in the best interest of the public to retain some or all facilities.
H. Subsistence Consultation for Permitted Activities	"Consultation" may take place by in-person meetings, teleconference, videoconference, and exchange of written documents, e-mail, or other means appropriate to the circumstances. Consultation does not include public meetings that are primarily for the purpose of information distribution, unless it is explained at the beginning of the meeting that there is an open dialogue, and that comments, concerns, or other information are being actively solicited.
	H-1 Required Operating Procedure **Objective:** Provide opportunities for participation in planning and decision-making to prevent unreasonable conflicts between subsistence uses and oil and gas and related activities. **Requirement/Standard:** Lessee/permittee shall consult directly with affected communities using the following guidelines. a) Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, the North Slope Borough, and the NPR-A Subsistence Advisory Panel to discuss the siting, timing and methods of proposed operations. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. b) The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to provide an adequate time for review and comment by the NPR-A Subsistence Advisory Panel and to allow time for formal government-to-government consultation with Native Tribal Governments. The applicant shall submit documentation of its consultation efforts and a written plan that shows how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Operations plans must include a discussion of the potential effects of the proposed operation, and the proposed operation in combination with other existing or reasonably foreseeable operations. c) A subsistence plan addressing the following items must be submitted. 1. A detailed description of the activity(ies) to take place (including the use of aircraft). 2. A description of how the lessee/permittee will minimize and/or deal with any potential impacts identified by the AO during the consultation process.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

[illegible]	[illegible]
H. Subsistence Consultation for Permitted Activities (continued)	**H-1 Required Operating Procedure** (continued) 3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community. 4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc. 5. Procedures necessary to facilitate access by subsistence users to conduct their activities. 6. In the event that no agreement is reached between the parties, the AO shall consult with the directly involved parties and determine which activities will occur, including the timeframes. 7. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the AO and Subsistence Advisory Panel.
	H-2 Required Operating Procedure **Objective:** Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration. **Requirement/Standard:** In addition to the consultation process described above for permitted activities, before applying for permits to conduct geophysical (seismic) exploration, the applicant shall consult with local communities and residents: a) Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify, in writing, all potentially affected long-term cabin and camp users. b) The official recognized list of cabin and campsite users is the North Slope Borough's 2001 (or most current) inventory of cabins and campsites. c) For the purpose of this standard, potentially affected cabins and campsites are defined as any camp or campsite within the boundary of the area subject to proposed geophysical exploration and/or within 1,200 ft of actual or planned travel routes used to supply the seismic operations while it is in operation. d) A copy of the notification letter and a list of potentially affected users shall also be provided to the office of the appropriate Native Tribal Government. e) Based on that consultation, the AO may prohibit seismic work up to 1,200 ft of any known, long-term, cabin or campsite. Generally, the AO will allow wintertime seismic work to be conducted within 300 ft of a long-term cabin or campsite that is not in use.

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Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

[illegible]	[illegible]
I. Orientation Programs Associated with Permitted Activities	**I-1 Required Operating Procedure** **Objective:** Minimize cultural and resource conflicts. **Requirement/Standard:** All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, required operating procedures, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the AO for review and approval and should: a) Provide sufficient detail to notify personnel of applicable stipulations and required operating procedures as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region. b) Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. c) Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d) Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating. e) Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f) Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities. g) Provide that individual training is transferable from one facility to another, except for elements of the training specific to a particular site. h) Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee. i) Include a module discussing bear interaction plans to minimize conflicts between bears and humans.
K. Area-Specific Lease Stipulations and Required Operating Procedures	**K-1 Lease Stipulation–Rivers** **Objective:** Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin- and camp-sites; the disruption of subsistence activities; and impacts to scenic and other resource values. (See ROP D-1 for restrictions on exploration activities.) **Requirement/ Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the stream bed and adjacent to the rivers listed below at the distances identified. These setbacks are measured from the centerline of the river as determined by the current hydrology at the time of application. The standard setback is ½ mi and increased to ¾ mi where subsistence cabin- and camp-sites are numerous. Along the Colville River and a portion of the Ikpikpuk

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

K. Area-Specific Lease Stipulations and Required Operating Procedures (continued)	**K-1 Lease Stipulation–Rivers** (continued) a 1-mi setback is required to protect important raptor habitat. (For locations along rivers where setback distances change, see Map 20.) On a case-by case basis, and in consultation with Federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings perpendicular to the main channel will be permitted (unless noted otherwise) through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event. a) Colville River: a 1-mi setback from the northern bluff (or bank if there is no bluff) of the Colville River extending the length of that portion of the river within the Planning Area. Road crossings intended to solely support oil and gas activities are prohibited. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes. This preserves the opportunity to plan, design, and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within NPR-A. b) Ikpikpuk River: a ¾-mi setback from the centerline of the Ikpikpuk River extending from the mouth south to Sec. 19, T7N, R11W, UM. From Sec. 19, T7N, R11W, UM to Sec. 4 T3N, R12W, UM, a 1-mile setback is required. Beginning at Sec. 4 T3N, R12W, UM, a ½-mi setback will be required to the confluence of the Kigalik River and Maybe Creek. NOTE: setback distances only apply to the west bank where the Ikpikpuk River is the Planning Area boundary. c) Alaktak River: a ¾-mi setback from the centerline of the Alaktak River extending from the mouth to the Ikpikpuk River. d) Chipp River: a ¾-mi setback from the centerline of the Chipp River extending from the mouth to the Ikpikpuk River. e) Oumalik River: a ¾-mi setback from the centerline of the Oumalik River from the mouth upstream to Sec. 5, T8N, R14W, UM, and a ½-mi setback from Sec. 5, T8N, R14W, UM, upstream to Sec. 2, T5N, R15W, UM. f) Titaluk River: a ½-mi setback from the centerline of the Titaluk Rivor from the confluence with the Ikpikpuk River upstream to Sec. 1, T2N, R22W, UM. g) Kigalik River: a ½-mi setback from the centerline of the Kigalik River from the confluence with the Ikpikpuk River upstream to the Planning Area boundary. h) Maybe Creek: a ½-mi setback from the centerline of the Maybe Creek from the confluence with the Ikpikpuk River upstream to Sec. 8, T2S R6W, UM. i) Topagoruk River: a ¾-mi setback from the centerline of the Topagoruk River from the mouth upstream to the confluence with Ishuktak Creek. A ½-mi setback from each bank upstream from the confluence with the Ishuktak to Sec. 3, T7N, R17W, UM. j) Ishuktak Creek: a ½-mi setback from the centerline of Ishuktak Creek from the confluence with the Topagoruk River to Sec. 24, T8N, R16W, UM. k) Meade River: a ¾-mi setback from the centerline of the Meade River upstream to Sec. 6, T6N, R21W, UM. A 1/2-mile setback from each bank upstream from Sec. 6, T6N, R21W, UM to the Planning Area boundary. l) Usuktuk River: a ¾-mi setback from the centerline of the Usuktuk River upstream from the confluence with the Meade River to Sec. 36, T10N, R19W, UM.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
K. Area-Specific Lease Stipulations and Required Operating Procedures (continued)	**K-1 Lease Stipulation–Rivers** (continued) m) Pikroka Creek a ¾-mi setback from the centerline of the Pikroka Creek upstream from the confluence with the Meade River to Sec. 11, T8N, R23W, UM. n) Nigisakturik River: a ¾-mi setback from the centerline of the Nigisakturik River upstream from the confluence with the Meade River to Sec. 1, T11N, R25W, UM. o) Inaru River: a ¾-mi setback from the centerline of the Inaru River from the mouth upstream to Sec. 17, T15N, R25W, UM. p) Kucheak Creek: a ¾-mi setback from the centerline of Kucheak Creek from the confluence with the Inaru River upstream to Sec. 20, T13N, R24W, UM. q) Avalik River: a ½-mi setback from the centerline of the Avalik River along that portion of the river within the Planning Area.
	K-2 Lease Stipulation–Deep Water Lakes **Objective:** Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deep water lakes; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; impacts to subsistence cabin- and camp-sites; and the disruption of subsistence activities. **Requirement/ Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within ¼ mi of the ordinary high water mark of any deep lake as determined to be in lake zone III, i.e., depth > 4m (Mellor, 1985). On a case-by case basis, and in consultation with Federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline, road crossings and other permanent facilities may be permitted through or in these areas where the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative.
	K-3 Lease Stipulation–Dease Inlet, Admiralty Bay, Elson Lagoon, and Associated Barrier Islands Lease stipulations for Dease Inlet, Admiralty Bay, Elson Lagoon, and the Barrier Islands, contain specific criteria that have been incorporated into stipulation language. Because of sensitive biological resources and/or subsistence concerns of Dease Inlet, Admiralty Bay, Elson Lagoon, and inland of the Barrier Islands, the standard(s) for exploration and development activities are set high with the burden of proof resting with the lessee to demonstrate to the AO that granting an approval is warranted. **Objective:** Protect fish and wildlife habitat, preserve air and water quality, and minimize impacts to traditional subsistence activities and historic travel routes on Dease Inlet, Admiralty Bay, and Elson Lagoon. **Requirement/Standard (Exploration):** Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on Dease Inlet, Admiralty Bay, and Elson Lagoon (including natural and barrier islands), between May 15 and October 15 of each season. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the Authorized Office that the actions or activities meet all of the following criteria: a) Exploration activities will not unreasonably conflict with traditional subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.

Table II-03
Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
K. Area-Specific Lease Stipulations and Required Operating Procedures (continued)	**K-3 Lease Stipulation–Dease Inlet, Admiralty Bay, Elson Lagoon, and Associated Barrier Islands** (continued) b) There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and "top-setting" of hydrocarbon-bearing zones. c) Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses. d) The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use traditional subsistence-related travel routes into and through Dease Inlet, Admiralty Bay and Elson Lagoon, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions. e) Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. **Requirement/Standard (Development):** With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within ¾ mi seaward of the shoreline (as measured from mean high tide) of Dease Inlet, Admiralty Bay, and Elson Lagoon or the natural islands (excluding Barrier Islands). Elsewhere, permanent facilities within Dease Inlet, Admiralty Bay, and Elson Lagoon will only be permitted on or under the water if they can meet all the following criteria: f) Design and construction of facilities shall minimize impacts to traditional subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources. g) Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to traditional subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources. h) The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through Dease Inlet, Admiralty Bay and Elson Lagoon as identified by the North Slope Borough. i) Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and "top-setting" of hydrocarbon-bearing zones.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
K. Area-Specific Lease Stipulations and Required Operating Procedures (continued)	**K-3 Lease Stipulation–Dease Inlet, Admiralty Bay, Elson Lagoon, and Associated Barrier Islands** (continued) j) Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound "direct spill" related impacts on area resources and subsistence uses. k) Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.
	K-4 Required Operating Procedure–Brant Survey Area **Objective:** Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing brant in the Brant Survey Area. **Requirement/Standard:** a) Aerial surveys for brant nesting colonies and brood-rearing areas shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding ½-mi area. These surveys shall be conducted following accepted BLM protocol. b) Development may be prohibited or activities curtailed within ½ mi of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.
	K-5 Required Operating Procedure–Caribou Study Area **Requirement/Standard:** Before authorization of construction of permanent facilities, the lessee shall design and implement a study of caribou movement, especially during the insect season. The study would include a minimum of 3 years of current data on caribou movements. The study design shall be approved by the AO and should provide information necessary to determine facility (including pipeline) design and location. Lessees may submit individual study proposals or they may combine with other lessees in the area to do a single, joint study for the entire Caribou Study Area. Study data may be gathered concurrently with other activities.
	K-6 Lease Stipulation–Coastal Areas **Objective:** Minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; to prevent contamination of marine waters; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. **Requirement/Standard:** In the Coastal Area, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines established to support exploration and development activities shall be located at least ¾ mi inland from the coastline to the extent practicable. Where, as a result of technological limitations, economics, logistics, or other factors, a facility must be located within ¾ mi inland of the coastline, the practicality of locating the facility at previously occupied sites, such as the former Cape Simpson, Peard Bay, or Wainwright DEW-line sites, shall be considered. Use of existing sites within ¾ mi of the coastline shall also be acceptable where it is demonstrated that use of such sites will reduce impacts to shorelines or otherwise be environmentally preferable. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users.

Table II-03

Stipulations and Required Operating Procedures for the Preferred Alternative (continued)

Activity	Stipulations and Required Operating Procedures for the Preferred Alternative
K. Area-Specific Lease Stipulations and Required Operating Procedures (continued)	**K-7 Required Operating Procedure–Colville River Special Area** **Objective:** Prevent or minimize loss of raptor foraging habitat. **Requirement/Standard:** If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as feasible. Within 15 mi of raptor nest sites, significant alteration of high quality foraging habitat shall be prohibited unless the lessee can demonstrate on a site-specific basis that impacts would be minimal or it is determined that there is no feasible or prudent alternative. Of particular concern are ponds, lakes, wetlands, and riparian habitats. Note: On a case-by case basis, and in consultation with appropriate Federal and State regulatory and resource agencies, essential pipeline and road crossings will be permitted through these areas where no other options are available.
	K-8 Lease Stipulation–Kasegaluk Lagoon Special Area **Objective:** Protect the habitat of the fish, waterfowl, and terrestrial and marine wildlife resources of Kasegaluk Lagoon, and protect traditional subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents. **Requirement/Standard:** Within the Kasegaluk Lagoon Special Area, oil and gas leasing is approved subject to the decision to defer the implementation of oil and gas leasing in the "Leasing Deferral Area." When leasing is implemented, no permanent oil and gas facilities are permitted within the boundary of the Special Area. Geophysical (seismic) exploration is authorized subject to the terms and conditions provided in other applicable ROP's. No restrictions are imposed on traditional subsistence activities and access for subsistence purposes.
L. Endangered Species Act Section 7 Consultation Stipulation	**L Lease Stipulation** The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation.

Note:
ROP = Required Operating Procedure

Table III-01
Discovered Fields, New Discovery Wells, and New Fields in and Adjacent to NPR-A

Field	[illegible]	[illegible]	[illegible]	
			Oil (MMbo)	Gas (Bcfg)
Discovered Fields in NPR-A				
Umiat	1946	Brookian Topset	70	Unknown
Fish Creek	1949	Brookian Topset	Unknown	Unknown
South Barrow	1949	Beaufortian	None	26
Simpson	1950	Brookian Topset	12	Unknown
Meade	1950	Brookian Topset	Unknown	20
Wolf Creek	1951	Brookian Topset	Unknown	Unknown
Gubik	1951	Brookian Topset	Unknown	600
Square Lake	1952	Brookian Topset	Unknown	58
East Barrow	1974	Beaufortian	None	13
Walakpa	1980	Beaufortian	Unknown	32-180
Sikulik	1988	Beaufortian	None	12
New Discovery Wells in NPR-A				
Rendezvous A	2000	Proprietary	Test 360 bopd and 6.6 MMcfgpd	
Spark 1	2000	Proprietary	No Test Rates Announced	
Spark 1A	2000	Proprietary	Test 1,550 bopd and 26.5 MMcfgpd	
Moose's Tooth C	2001	Proprietary	No Test Rates Announced	
Lookout 1	2001	Proprietary	No Test Rates Announced	
Rendezvous 2	2001	Proprietary	No Test Rates Announced	
Fields Adjacent to NPR-A				
East Umiat	1963	Brookian Topset	Unknown	4
Colville River Unit-Satellite (Fiord)	1992	Beaufortian	55	Unknown
Alpine	1994	Beaufortian	500	60
Tabasco	1995	Brookian Topset	30	Unknown
Tarn	1997	Brookian Turbidites	42	39
Meltwater	2000	Brookian Turbidites	52	32 (est)

Key:
Bcfg = Billion cubic feet of gas.
bopd = barrels oil per day.

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Mmbo = Million barrels of oil.
MMcfgpd = Millions cubic feet gas per day.

Sources:
Kornbrath et al., 1997; Bird, 1991; Alaska, Department of Natural Resources, 2000, *PI/Dwight's Plus Drilling Wire*, 2001a, b, c; Gingrich, 2001.

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Table III-02
Potential Hazardous Materials Sites and Abandoned Oil and Gas Exploration Wells in NW NPR-A

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Potential Hazardous Materials Sites						
Peard Bay DEW Station (LIZ C)	70°15.00N	158°15.00W	17 N	24 W	19	UM
Cape Simpson DEW (POW A)	71°04.00N	154°44.00W	20 N	11 W	26	UM
Skull Cliff Loran Annex DEW	70°02.00N	157°18.00W	18 N	21 W	–	UM
Elson Lagoon	–	–	23 N	18 W	–	UM
Abandoned Oil and Gas Exploration Wells						
Avak Test Well #1	71° 15.035N*	156° 28.064W*	22 N	17 W	20	UM
East Oumalik	69° 47.478N	155° 32.566W	5 N	15 W	13	UM
East Simpson #1	70° 55.060N	154° 37.300W	18 N	10 W	18	UM
East Simpson #2	70° 58.425N	154° 40.257W	19 N	11 W	23	UM
East Topagoruk Test Well #1	70° 34.689N	155° 23.305W	14 N	14 W	12	UM
Iko Bay Test Well #1	71° 10.287N*	156° 10.434W*	21 N	16 W	16	UM
Knifeblade Test Well #1	69° 09.067N*	154° 53.350W*	3 S	12 W	25	UM
Knifeblade 2 & 2a Test Wells	69° 08.316N*	154° 44.198W*	4 S	12 W	2	UM
Kuyanak Test Well #1	70° 55.863N*	156° 04.090W*	18 N	16 W	10	UM
Meade Test Well #1	70° 02.498N	157° 29.382W	8 N	22 W	19	UM
North Simpson Test Well #1	71° 03.190N	154° 58.439W	20 N	12 W	26	UM
Oumalik Test Well #1	69° 50.495N	155° 58.272W	6 N	16 W	30	UM
Peard Bay Well Site	70° 42.912N	159° 00.257W	16 N	28 W	25	UM
Simpson Test Well #1	70° 57.158N	155° 21.677W	19 N	11 W	32	UM
Simpson Core Test #1	70° 55.700N*	155° 17.367W*	18 N	13 W	10	UM
Simpson Core Test #2	70° 55.650N*	155° 17.500W*	18 N	13 W	10	UM
Simpson Core Test #3	70° 55.642N*	155° 17.500W*	18 N	13 W	10	UM
Simpson Core Test #4	70° 55.767N*	155° 15.867W*	18 N	13 W	10	UM
Simpson Core Test #5	70° 56.283N*	155° 16.750W*	18 N	13 W	3	UM
Simpson Core Test #6	70° 55.967N*	155° 18.550W*	18 N	13 W	9	UM
Simpson Core Test #7	70° 55.812N*	155° 18.150W*	18 N	13 W	9	UM
Simpson Core Test #8	70° 56.717N*	155° 17.633W*	18 N	13 W	3	UM
Simpson Core Test #9	70° 57.450N*	155°17.517W*	19 N	13 W	34	UM
Simpson Core Test #10	70° 57.717N*	155° 17.533W*	19 N	13 W	34	UM
Simpson Core Test #11	70° 58.817N*	155° 17.533W*	19 N	13 W	22	UM
Simpson Core Test #12	70° 58.317N*	155° 17.500W*	19 N	13 W	27	UM
Simpson Core Test #13	70° 58.979N	154° 38.429W	19 N	11 W	24	UM
Simpson Core Test #14	70° 58.813N	154° 39.333W	19 N	11 W	24	UM
Simpson Core Test #14a	70° 58.791N	154° 39.538W	19 N	11 W	24	UM
Simpson Core Test #15	70° 58.894N	155° 38.970W	19 N	11 W	24	UM
Simpson Core Test #16	70° 59.000N*	155° 37.867W*	19 N	11 W	24	UM
Simpson Core Test #17	70° 59.200N*	155° 38.550W*	19 N	11 W	24	UM
Simpson Core Test #18	70° 59.633N*	155° 40.217W*	19 N	11 W	23	UM
Simpson Core Test #19	70° 59.257N*	155° 42.950W*	19 N	11 W	22	UM
Simpson Core Test #20	70° 59.817N*	155° 35.317W*	19 N	10 W	19	UM

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Site Name	Latitude	Longitude	[illegible]	[illegible]	[illegible]	[illegible]
Simpson Core Test #21	70° 59.482N*	154° 38.888W*	19 N	11 W	13	UM
Simpson Core Test #22	70° 59.533N*	154° 36.250W*	19 N	10 W	19	UM
Simpson Core Test #23	71° 02.087N*	154° 38.833W*	19 N	11 W	16	UM
Simpson Core Test #24	71° 01.767N*	154° 37.017W*	19 N	10 W	6	UM
Simpson Core Test #25	71° 58.167N*	154° 42.300W*	18 N	11 W	3	UM
Simpson Core Test #26	70° 55.919N	154° 42.684W	18 N	11 W	11	UM
Simpson Core Test 27	70° 56.883N	154° 41.848W	18 N	11 W	11	UM
Simpson Core Test #28	70° 59.273N	154° 36.201W	19 N	11W	19	UM
Simpson Core Test #29	70° 56.53N	154° 42.880W	18 N	11 W	11	UM
Simpson Core Test #30	70°55.571N	154° 42.320W	18 N	11 W	11	UM
Simpson Core Test #31	69°50.302N	155° 59.387W	19 N	11 W	35	UM
South Meade Test Well #1	70°36.53N	156° 53.23W	15 N	19 W	31	UM
South Simpson Test Well #1	70°48.412N	152° 58.915W	17 N	12 W	22	UM
Square Lake Test Well #1	69°31.828N	153° 06.170W	2 N	6 W	2	UM
Titaluk #1	69°25.350N	154° 34.087W	1 N	11 W	28	UM
Topagoruk Test Well #1	70°37.391N	155° 55.257W	15 N	16 W	25	UM
Tulageak Test Well #1	71°11.345N*	155° 44.228W*	21 N	14 W	7	UM
Tunalik Test Well #1	70°11.814N*	161° 04.319W*	10 N	36 W	20	UM
West Dease Test Well #1	71°09.524N	155° 37.983W	21 N	14 W	21	UM

Notes:

* Latitude/Longitude data are NAD27. All other data are WGS84 (NAD 83).

-- Not available or not applicable.

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Table III-03
Onshore Climate of Alaska's North Slope

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			
Distance to the ocean (km)	150 to 300	200 to 150	<20
Elevation (m)	300 to 1,000	50 to 400	<50
[illegible]			
Mean diurnal amplitude	10 to 15	8 to 14	4 to 8
Range (extreme low-high)	-0 to + 30	-65 to + 35	-50 to + 26
Mean annual	-8.6	-12.4 ± 0.4	-12.4 ± 0.4
Annual amplitude	16.8	21.1 ± 0.5	17.5 ± 1.2
[illegible]			
Freeze	4,000	5,300 ± 70	4,930 ± 150
Thaw	800	930 ± 160	420 ± 120
[illegible]			
Snow	156	126	113
Rain	168	103	85
Annual total	324	229	198
[illegible]			
Average starting date	27 Sept.	1 Oct.	27 Sept.
Range	11 Sept. to 15 Oct.	19 Sept. to 12 Oct.	4 Sept. to 14 Oct.
Average duration (days)	243	236	259
Range (extreme)	226 to 261	198 to 260	212 to 288
Average maximum thickness (cm)	–	43	32
Range (extreme)	–	28 to 70	10 to 83
[illegible]			
Average starting time	28 May	25 May	6 June
Range (extreme)	16 May to 15 June	28 April to 6 June	26 May to 19 June
Average length (days)	122	129	106
Range (extreme)	104 to 139	105 to 167	77 to 153

Note:
[1] Natural Resources Conservation Service, 1994.

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Key:

cm = Centimeters.
km = Kilometers.
m = Meters.
mm = Millimeters.
°C = Degrees Celsius.

Source:

Zhang, Osterkamp, and Stamnes, 1996.

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Table III-04
Ambient Air Quality Standards for North Slope Alaska

[illegible]	Annual	24-hr	8-hr	3-hr	1-hr	30-min
Total Suspended Particulates[2]	60[3]	150	*	*	*	*
Class II[4]	19[3]	37	*	*	*	*
Carbon Monoxide	*	*	10,000	*	40,000	*
Ozone[5]	*	*	*	*	235[6]	*
Nitrogen Dioxide	100[7]	*	*	*	*	*
Class II[4]	25[7]	*	*	*	*	*
Inhalable Particulate Matter (PM_{10})[8]	50[9]	150[10]	*	*	*	*
Class II[4]	17	30	*	*	*	*
Lead	1.5[11]	*	*	*	*	*
Sulfur Dioxide	80[7]	365	*	1,300	*	*
Class II[4]	20[7]	91	*	512	*	*
Reduced Sulfur Compounds[2]	*	*	*	*	*	50

Notes:

[1] All-year averaging times not to be exceeded more than once each year, except that annual means may not be exceeded.
[2] Alaska, Department of air-quality standard.
[3] Annual geometric mean.
[4] Class II standards refer to the Prevention of Significant Deterioration (PSD) Program. The standards are the maximum increments in pollutants allowed above previously established baseline concentrations.
[5] The State ozone standard compares with national standards for photochemical oxidants, which are measured as ozone.
[6] The 1-hour standard for ozone is based on a statistical rather than a deterministic allowance for an "expected exceedance during a year."
[7] Annual arithmetic mean.
[8] PM_{10} is the particulate matter less than 10 micrometers in aerodynamic diameter.
[9] Attained when the expected annual arithmetic mean concentration, as determined in accordance with 40 CFR 50 subpart K, is equal to or less than 50 µg/m³.
[10] Attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m³, as determined in accordance with 40 CFR 50, subpart K, is equal to or less than 1.
[11] Maximum arithmetic mean averaged over a calendar quarter.

Key:
* No standards have been established.
µg/m³ = Micrograms per cubic meter.

Sources:
Alaska Department of Environmental Conservation, 1982; 80, 18, AAC 50.010, 18 AAC 50.020; 40 CFR 52.21 (43 FR 26388); 40 CFR 50.6 (52 FR 24663); 40 CFR 51.166 (53 FR 40671).

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Table III-05
Measured Air Pollutant Concentrations [9] at Prudhoe Bay, Alaska (1986-1996)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ozone						
Annual Max. 1 hr	115.8	180.3	115.6	100.0	235	—
Nitrogen Dioxide						
Annual	28.3	11.9	18.0	4.9	100	25
Inhalable Particulate Matter (PM10)						
Annual	—	—	10.5	—	50	17
Annual Max. 24 hr	29.3	—	25.0 [8]	—	150	30
Sulfur Dioxide						
Annual	2.6	—	5.2	2.6	80	20
Annual Max. 24 hr	10.5	—	26.2 [8]	13.1	365	91
Annual Max. 3 hr	13.1	—	44.5	55.0	1,300	512
Carbon Monoxide						
Annual Max. 8 hr	—	—	1,400	—	10,000	—
Annual Max. 1 hr	—	—	2,500 [8]	—	40,000	—

Notes:

[1] Lead was not monitored.

[2] Site CCP (Central Compressor Plant), Prudhoe Bay monitoring program, selected for maximum pollutant concentrations. All data is for years 1992-1996.

[3] Site Pad A (Drill Pad A), Prudhoe Bay monitoring program, site of previous monitoring, selected to be more representative of the general area or neighborhood. All data is for years 1992-1996.

[4] Site CPF-1 (Central Processing Facility), Kuparuk monitoring program, selected for maximum pollutant concentrations. Ozone, nitrogen dioxide, and sulfur dioxide are for years 1990-1992; PM_{10} and carbon monoxide data is for 1986-1987.

[5] Site DS-1F, Kuparuk monitoring program site selected to be representative of the general area or neighborhood. All data is for years 1990-1992.

[6] Applicable National Ambient Air Quality Standards. See Table III-08 for more specific definitions of air-quality standards.

[7] Class II PSD Standard increments.

[8] Second highest observed value (in accordance with approved procedures for determining ambient-air quality).

[9] Micrograms per cubic meter.

— No data available.

Sources:

ERT Company, Inc., 1987; Environmental Science and Engineering, 1987; ENSR, 1996, as cited in U.S. Army Corps of Engineers, 1999.

Table III-06
NW NPR-A Land Cover Classifications

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Water	>60% Water	
Ice	≥60% ice	2.3
Clear Water	depth >1 m and no turbidity	7.6
Turbid Water	depth ≤1 m or turbid	6.8
[illegible]	[illegible]	
Carex aquatilis	>15% *Carex aquatilis*	2.0
Arctophila fulva	>15% *Arctophila fulva*	0.6
[illegible]	[illegible]	
Low Centered Polygons	≥5% sedge/grass	5.9
Non-Patterned	<5% sedge/grass	4.0
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
Sedge/Grass Meadow	≥50% sedge/grass and <40% tussock	6.6
Tussock Tundra	>40% tussock cotton grass	23.5
Moss/Lichen	≥50% moss and/or lichen	1.7
[illegible]	[illegible]	
Dwarf	≤30 cm in height	27.0
Low	>30 cm but <1.5 m in height	4.1
Tall	≥1.5 m in height	0.0
[illegible]	[illegible]	
Sparsely Vegetated	10-30% vegetated	0.3
Dunes/Dry Sand	<10% vegetation and <10% wet sand, mud, or rock	0.4
Other	<10% vegetation and <10% wet sand, mud, or rock	0.7

Key:
cm = Centimeter.
m = Meter.
≥ = Equal to or greater than.
> = Greater than.
≤ = Equal to or less than.
< = Less than.
% = Percent.

Table III-07
Occurrence and Representative Abundance and Density of Selected Birds in NW NPR-A

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
Red-throated Loon	C	early June – late September	3,065	70	0.09
Pacific Loon	C	late May – late September	27,366	70	0.68
Yellow-billed Loon	U	mid May – mid September	2,898	59	0.03
Tundra Swan	C	mid May – early October	9,961	52	0.20
White-fronted Goose	C	mid May – mid September	120,202	59	2.20
Brant	FC	late May – early September	9,750	30	0.12
Canada Goose	FC	early June – mid September	18,758	11	0.32
Northern Pintail	A	late May – mid September	226,612	61	1.77
Scaup	C	late May – mid-September	33,074	68	0.12
Common Eider	C	late May – late October	2,682	31	0.01
King Eider	A	late May – October	12,884	42	0.42
Long-tailed Duck	A	late May – October	110,896	66	1.08
Scoters	C	late May – early September	11,253	25	0.01
[illegible]					
Common Raven	U	Resident	66	—	0.002
Lapland Longspur	A	mid May – early September	—	—	24.3 - 64.2
[illegible]					
Arctic Peregrine Falcon	U	mid April – mid September	—	—	—
Gyrfalcon	U	Resident	100	—	—
Rough-legged Hawk	U	late April – early October	600-1,000	—	—
Snowy Owl	FC	Resident	858	68	0.03
[illegible]					
Glaucous Gull	C	early May – November	17,575[illegible]	62	0.40
Sabine's Gull	FC	late May – early September	11,096[illegible]	65	0.21
Arctic Tern	C	late May – early September	22,330[illegible]	68	0.31
Jaegers	FC	late May – mid September	7,102	61	0.14
[illegible]					
Ptarmigan	C	Resident	—	—	4.0 - 9.0

Notes:

[1] Status: A = Abundant; C = Common; FC = Fairly Common; U = Uncommon;

[2] Resident = Present throughout the year.

[3] Database: Most species, average for late June-early July 1986-2002 Breeding Pair Survey area (Mallek, Platte, and Stehn, 2003); Common eider, nearshore area 1999-2002 (Dau and Hodges, 2003); King eider, Snowy owl, Common raven, mid-June average 1993-2002, Eider Survey area (Larned, Stehn, and Platte, 2003); Peregrine falcon, Gyrfalcon, Rough-legged hawk, 1999 (non-Colville River sightings; Ritchie and Wildman, 2000) and 2001 (Colville

River sightings; Swem, 2001, pers. commun.).

[4] Values calculated from mid-June Eider Survey data of Larned et al. (2001) except common eider from Dau and Hodges (2003). The Northwest NPR-A Planning Area = 60% of the total ACP eider survey area.

[5] June indices in Eider Survey area (Larned et al., 2001) except ptarmigan, longspur.

[6] 1992-2002 data.

Key:

ACP = Arctic Coastal Plain

km^2 = Square kilometer

– Data not available.

Sources:

Dau and Hodges, 2003; Larned et al., 2001; Larned, Stehn, and Platte, 2003; Mallek, Platte, and Stehn, 2003; Ritchie and Wildman, 2000; Swem, 2001, pers. commun.

Table III-08
Chronology of Activities for Selected Birds Nesting on the Arctic Coastal Plain in NW NPR-A

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Loons	late May-early June	mid June-late June	mid July-late July	mid July-early September	Winter	late August-September
Tundra Swan	mid May-late May	late May-early June	late June-mid July	late June-mid September	mid July-August	late September-early October
Brant	late May-early June	early June-late June	late June-mid July	late June-early September	mid July-mid August [1]	mid August-early September
Greater White-fronted Goose	mid May-early June	late May-mid June	late June-early July	late June-late August	mid July-early August [2]	mid August-mid September
Northern Pintail Males	late May	mid June-late June	early July-late July	early July-early September	mid July-early August	early August-mid September [4]
King Eider	mid May-late May	mid June-early July	early July-late July	early July-early August	early July-early August [5]	early August-late October [5]
Long-tailed Duck	late May	late June-early July	mid July-late July	mid July-early September	late July-early September [3]	late September-October

Notes:

1 Nonbreeding, failed breeder, molt migrant: late June-early August.
2 Nonbreeding young of the previous year and failed breeders molt in late June.
3 Includes males, nonbreeders, failed breeders, and females with broods.
4 Male pintails depart early July-early August.
5 Males stage in Beaufort Sea for 2-3 weeks before molt-migration starts in mid July; females stage in Beaufort Sea mid-July to late August before they depart in early August.

Sources:
Austin and Miller, 1995; Burgess and Stickney, 1994; Dickson, Suydam, and Balogh, 2000; Ely and Dzubin, 1994; Johnson and Herter, 1989; King, 1998, pers. comm.; Limpert and Earnst, 1994; North, 1994

Table III-09
Breeding Status and Population of Shorebirds in NW NPR-A

Black-bellied Plover	B	U	3.2- 6.3
Lesser Golden-Plover	B	U	0.0-1.3
Bar-tailed Godwit	B	U	0.0-1.2
Red-necked Phalarope	B	C	4.2-9.7
Red Phalarope	B	U	4.0-20.6
Long-billed Dowitcher	B	U	0.0-3.7
Stilt Sandpiper	B	R	–
Ruddy Turnstone	B	U	0.0-0.2
Dunlin	B	U/C	0.5-21.1
Semipalmated Sandpiper	B	C	6.9-7.0
Baird's Sandpiper	B	U/FC	–
Pectoral Sandpiper	B	C	22.9-24.1
Buff-breasted Sandpiper	B	R	–

Note:
– Data not available.

Key:
A = Abundant
B = Breeding
C = Common
FC = Fairly Common
R = Rare
U = Uncommon

Sources:
Derksen, Rothe, and Eldridge, 1981; Johnson and Herter, 1989; Pitelka, 1974.

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Table III-10
Southcentral Alaska and Fairbanks Employment Estimates (1995-2000)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Anchorage-Matanuska Region	131	132	135	141	144	148
Kenai Peninsula Borough	16	16	16	17	17	–
Fairbanks North Star Borough	31	31	32	33	33	34
Three-area subtotal	178	179	183	191	194	199[1]
Total	**261**	**264**	**269**	**275**	**278**	**284**

Notes:
[1] Assumes 17,000 employed in Kenai Peninsula Borough.
– Data not available as of November, 2001.

Source:
Alaska Department of Labor and Workforce Development, Research and Analysis Section.

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Table III-11
North Slope Borough Area Employment by Industry[1] for Years 1990-1998[2]
(Nonagricultural Wage and Salary Employment)

Total Industries	9,185	9,208	8,400	8,823	9,570	9,114	9,149	9,102	9,404
Mining	5,126	5,018	4,411	4,213	4,617	4,436	4,431	4,158	4,753
Construction	373	484	387	381	623	415	344	354	371
Manufacturing	0	0	0	0	0	2	3	7	8
Transportation, Communication, & Utilities	382	384	241	238	378	403	428	440	435
Wholesale Trade	0	0	0	0	0	0	0	0	0
Retail Trade	252	205	213	487	522	481	524	540	567
Finance, Ins., R.E.	183	177	167	166	166	145	143	175	177
Services	976	1,031	1,008	1,308	949	804	890	1,048	1,035
Government	1,901	1,929	1,964	2,040	2,315	2,428	2,385	2,293	2,068
Federal	107	98	78	57	70	78	43	38	28
State	32	64	60	59	58	59	57	52	56
Local	1,762	1,767	1,827	1,925	2,187	2,293	2,286	2,204	1,983
Miscellaneous	0	0	5	0	0	0	1	1	1
Total Without Mining	**4,059**	**4,190**	**3,989**	**4,610**	**4,953**	**4,678**	**4,718**	**4,944**	**4,651**

Notes:
[1] Mining is completely oil and gas industry employment in the NSB.
[2] Data for 1999 and 2000 not available as of November 2001.

Source:
Alaska Department of Labor and Workforce Development, Research and Analysis Section.

Table III-12
North Slope Borough Employment by Employer and by Community[1]

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Village Corporation[2]	413	17	16	20	5	9	81	5	15	20
NSB School District	298	12	16	20	5	9	176	11	7	9
NSB Government	998	41	38	45	34	61	671	44	35	46
City Government	59	2	0	0	0	0	30	2	4	5
State and Federal Government	74	3	2	3	2	4	53	3	3	4
All Other Employees	606	25	10	13	10	18	530	34	12	16
Total Without Mining	2,476	100[3]	80	100[3]	56	100[3]	1,541	100[3]	76	100[3]
[illegible]	Employed	%	Employed	%	Employed	%	Employed	%	—	—
Village Corporation[2]	35	27	71	32	6	8	48	20	—	—
NSB School District	8	6	33	15	16	20	28	12	—	—
NSB Government	38	31	61	27	44	55	70	29	—	—
City Government	7	7	9	4	1	2	0	0	—	—
State and Federal Government	3	2	6	3	2	3	9	4	—	—
All Other Employees	35	28	42	19	11	14	84	35	—	—
Total Less Mining	124	100[3]	132	100[3]	80	100[3]	235	100[3]	—	—

Notes:
[1] Results represent only those individuals responding to the census survey.
[2] Includes Arctic Slope Regional Corporation.
[3] Percentages may not total 100 because of rounding.

Key:

* = North Slope Borough area.

** = Percent of survey respondents only.

Source:

North Slope Borough, 1999.

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Table III-13
1999 NSB* Employment by Employer and Employee Ethnicity [1]

Federal Government	17	11	11	39
State Government	9	19	7	35
City Government	43	8	6	57
NSB Government	509	217	151	877
NSB School District	134	108	47	289
NSB CIP	82	23	7	112
Oil Industry	10	4	2	16
Private Construction	44	14	8	66
ASRC or Subsidiary	90	26	16	132
Village Corporations	225	33	17	275
Financial/Insurance	0	1	0	1
Transportation	14	17	12	43
Communications	0	4	1	5
Trade	14	9	12	35
Service	28	36	19	83
Ilisagvik College	21	36	12	69
Other	171	68	45	285
Total	*1,411*	*634*	*373*	*2,418*

Notes:
[1] Results include only those individuals responding to the census survey.
* North Slope Borough area.

Key:
ASRC = Arctic Slope Regional Corporation.
CIP = Capital Improvement Program.

Source:
North Slope Borough, 1999

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Table III-14
1998 North Slope Labor Force by Community

Labor Force	3,823	147	98	2,508	141	176	356	100	374
Permanent/Full-time	2,114	58	45	1,565	62	85	134	50	140
Temporary/Seasonal	523	21	11	287	19	56	53	20	54
Part-time	222	12	8	91	8	13	57	9	32

Note:
* North Slope Borough area.

Source:
North Slope Borough, 1999.

Table III-15
1998 North Slope Borough Unemployment and Underemployment by Community

	[illegible]	Anaktuvuk Pass	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Unemployment (%)	16	7	40	10	15	10	23	16	13
(The number of people who believed they were underemployed)									
Underemployment (%)	13	7	8	12	14	27	17	12	5
(Those who worked less than 40 weeks in 1998)									
Underemployment (%)	27	23	44	24	41	62	46	39	33

Note:
* North Slope Borough area.

Source:
North Slope Borough, 1999.

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Table III-16
1998 Annual Household Subsistence Expenditure by Ethnicity in the North Slope Borough

0	90	11	7	108
1 to 500	139	20	11	170
501 to 1,000	103	12	10	125
1,001 to 2,000	82	6	7	95
2,001 to 4,000	97	9	1	107
4,001 to 6,000	97	10	2	109
6,001 to 8,000	78	3	0	81
8,001 to 10,000	43	2	1	46
10,001 or More	112	6	1	119
Total	**841**	**79**	**40**	**960**

Note:
Results include only those households responding to the census survey and to the question, "During the recent calendar year, what is your best estimate of the money you spent for subsistence activities?"

Source:
North Slope Borough, 1999.

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Table III-17
Percentages of Edible Pounds of Subsistence Resources for Point Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bowhead Whale	0.0	29.0	21.3	37.7	—	28.7	0.0
Caribou	17.1	23.7	58.2	26.6	57.0	30.6	58.0
Pacific Walrus	4.2	33.6	4.6	9.0	2.0[2]	0.0	—
Bearded Seal	2.1	3.7	4.3	2.4	—	2.7	2.0[3]
Hair Seal	2.1	1.1	4.3	2.4	—	2.7	2.0[3]
Beluga Whale	60.4	0.0	0.5	0.0	—	0.0	—
Polar Bear	0.6	1.7	0.3	1.5	—	0.0	—
Moose	2.2	0.0	0.3	3.4	—	1.6	5.0
Dall Sheep	0.0	0.0	0.0	*	—	0.0	—
Muskox	0.0	0.0	—	—	—	0.0	—
Small Land Mammals	—[4]	—[4]	0.1	*	—[4]	*	—[4]
Birds[5]	5.4	2.1	0.9	3.5	3.0	1.5	5.0
Fish	2.7	4.9	6.6	11.3	37.0	33.7	30.0
Vegetation	0.2	—	—	—	1.0	1.4	*
Total Harvest (in pounds)	[illegible]	[illegible]	[illegible]	[illegible]	—[6]	[illegible]	—[6]
Per Capita Harvest (in pounds)	890.1	751.24	540.0	233.10	—	741.75	—

Notes:

[1] Averaged for the period.
[2] Ringed and bearded seals provided 2%.
[3] Represents all marine mammals harvested in 1994-95: 1 polar bear and 23 ringed seals.
[4] Not harvested for food.
[5] Birds and eggs.
[6] Not calculated in report.

Key:

* = less than 0.1 percent.
— = Data not available.

Sources:

Stoker, 1983, as cited by ACI/Braund, 1984; S.R. Braund and Associates, 1989b; State of Alaska, Department of Fish and Game, 1995b; Brower and Opie, 1997a,b; Opie, Brower, and Bates, 1997.

Table III-18
North Slope Subsistence Resources by Common Name, Inupiaq Name, and Scientific Name

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]							
Bearded seal	Ugruk	*Erignathus barbatus*	√	√	√	√	√
Ringed seal	Natchiq	*Phoca hispida*	√	√	√	√	√
Spotted seal	Qasigiaq	*Phoca largha*	√	√	√	√	√
Ribbon seal	Qaigulik	*Phoca fasciata*	√	√	√	√	—
Beluga whale	Quilalugaq	*Delphinapterus leucas*	√	√	√	√	—
Bowhead whale	Agviq	*Balaena mysticetus*	√	√	√	√	√
Polar bear	Nanuq	*Ursus maritimus*	√	√	√	√	√
Walrus	Aiviq	*Odobenus rosmarus*	√	√	√	√	—
Terrestrial Mammals							
Caribou	Tuttu	*Rangifer tarandus*	√	√	√	√	√
Moose	Tuttuvak	*Alces alces*	—	√	√	√	√
Brown bear	Aklaq	*Ursus arctos*	√	√	√	√	√
Dall sheep	Imnaiq	*Ovis dalli*	—	√	√	√	√
Musk ox	Umimmaq	*Ovibus moschatus*	—	√	—	√	√
Arctic fox (Blue)	Tigiganniaq	*Alopex lagopus*	√	√	√	√	√
Red fox[a]	Kayuqtuq	*Vulpes fulva*	√	√	√	√	√
Porcupine	Qinagluk	*Erethizon dorsatum*	—	√	√	—	—
Ground squirrel	Siksrik	*Spermophilus parryii*	√	√	√	√	√
Wolverine	Qavvik	*Gulo gulo*	√	√	√	√	√
Weasel	Itigiaq	*Mustela erminea*	—	√	—	√	√
Wolf	Amaguk	*Canis lupus*	√	√	√	√	√
Marmot	Siksrikpak	*Marmota broweri*	√	√	—	√	√
Fish							
Salmon (ns)	—	—	√	√	√	√	√
Chum	Iqalugruaq	*Oncorhynchus keta*	√	√	√		√
Pink (humpback)	Amaqtuuq	*Oncorhynchus gorbuscha*	—	√	√	√	√
Silver (coho)	Iqalugruaq	*Oncorhynchus kisutch*	—	—		—	√
King (chinook)	—	*O. tshawytscha*	—	—		—	
Sockeye	—	*Oncorhynchus*	—	—		—	—
[illegible]							
Other coastal fish	—	—	—				
Capelin	Pagmaksraq	*Mallotus villosus*	—				
Rainbow smelt	Ilhuagniq	*Osmerus mordax*	√	√	√	—	√
Arctic cod	Iqalugaq	*Boreogadus saida*	—	√	√	√	√
Tomcod	Uugaq	*Eleginus gracilis*	√	√	√	√	—
Flounder (ns)	Nataagnaq	*Liopsetta glacialis*	—				
Birds							
Snowy owl	Ukpik	*Nyctea scandiaca*	—	√	—	—	√
Red-throated loon	Qaqsraupiagruk	*Gavia stellata*	√	√	√		
Tundra swan	Qugruk	*Cygnus columbianus*	—	√	—	√	√
Elder	—	—	—	—	—	—	—
Common eider	Amauligruaq	*Somateria mollissima*	√	√	√	√	√
King eider	Qinalik	*Somateria spectabilis*	√	√	√	√	√
Spectacled eider	Tuutalluk	*Somateria fischeri*	√	√	√	—	—
Steller's eider	Igniqauqtuq	*Polysticta stelleri*	√	√	√	—	—
Other ducks (ns)	Qaugak	—	—	√	√	√	—
Pintail	Kurugaq	*Anas acuta*	√	√	—	√	—
Long-tailed ducks	Aaqhaaliq	*Clangula hyemalis*	√	√	√	√	—
Surf scoter	Aviluktuq	*Melanitta perspicillata*	—	√	√	—	—
Goose	—	—	—	—	—	—	—
Brant	Niglingaq	*Branta bernicla n.*	√	√	√	√	√
White-fronted g.	Niglivialuk	*Anser albifrons*	√	√	√	√	√
Snow goose	Kanuq	*Chen caerulescens*	√	√	√	√	√
Canada goose	Iqsragutilik	*Branta canadensis*	√	√	√	√	√
Ptarmigan (ns)	Aqargiq	*Lagopus sp.*	—	√	√	√	√
Willow ptarmigan	Nasaullik	*Lagopus lagopus*	√	√	√	—	—
Other Resources							
Berries (ns)	—	—	√	√	√	√	√
Blueberry	Asiaq	*Vaccinium*	√	√	√	—	—

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(rnd)		*nerka*								*uliginosum*					
Whitefish (ns)	Aanaakliq	*Coregonus sp.*	—	√	√	√	—	Cranberry	Kimminnaq	*Vaccinium vitis-idaea*	—	√	√	—	—
Round w.f.	Aanaakliq	*Prosopium cylindraceum*	—	√	√	—	—	Salmonberry	Aqpik	*Rubus spectabilis*	—	√	√	—	—
Broad w.f.	Aanaakliq	*Coregonus nasus*	—	√	√	√	√	**Bird eggs (ns)**	Mannik	—	√	√	√	√	—
Humpback w.f.	Pikuktuuq	*Coregonus clupeaformis*	—	√	√	√	√	Gull eggs	—	—	—	√	—	√	—
Least cisco	Iqalusaaq	*Coregonus sardinella*	—	√	√	√	√	Geese eggs	—	—	—	√	—	√	—
Bering,Arctic cisco	Qaaktaq	*Coregonus autumnalis*	√	√	√	√	√	Eider eggs	—	—	—	√	√	√	—
Other freshwater fish								**Greens/roots (ns)**	—	—	—	√	√	√	√
Arctic grayling	Sulukpaugaq	*Thymallus arcticus*	√	√	√	√	√	Wild rhubarb	Qunulliq	*Oxyria digyna*	—	√	√	—	—
Arctic char	Iqalukpik	*Salvelinus alpinus*	√	√	√	√	√	Wild chives	Quagaq	*Allium schoenoprasum*	—	√	√	—	—
Burbot (Ling cod)	Tittaaliq	*Lota lota*	—	√	√	√	√	Clams	Imaniq	—	√	√	√	—	—
Lake trout	Iqaluaqpak	*Salvelinus namaycush*	—	√	√	√	√	Crab	Puyyugiaq	—	√	√	—	√	√
Northern pike	Siulik	*Esox lucius*	—	√	√	—	—	Wood	—	—	—	—	—	√	√
—	—	—	—	—	—	—	—	Fresh water	Imiq	—	—	√	√	—	—
—	—	—	—	—	—	—	—	Fresh water ice	Sikutaq	—	—	√	√	—	—
—	—	—	—	—	—	—	—	Sea ice	Siku	—	—	√	√	—	—

Notes:

[1] Point Lay resources used 1987.

[2] Wainwright resources used 1987–1990.

[3] Barrow resources used 1987–1990.

[4] Atqasuk resources used 1992–1993.

[5] Nuiqsut resources used 1993.

[6] Red fox (Cross, Silver).

[7] Harvest of silver, king, and sockeye salmon is rare.

An unchecked box might mean a resource was not used or, especially in the case of "Other Resources," the resource might have been used but use was reported as "berries" rather than "blueberries" for example.

Key:

ns = Nonspecified.

w.f. = Whitefish.

— = Not available or not applicable.

Source:
S.R. Braund and Associates and University of Alaska, Anchorage, Institute of Social and Economic Research, 1993; Pedersen,1995a,b; S.R. Braund and Associates.,1996.

Table III-19
Proportion of Inupiat Household Food Obtained from Subsistence

Proportion *	1977	1988	1993	1998
None	13	20	18	2
Less Than Half	42	31	25	29
Half	15	14	15	22
More Than Half	30	35	42	47

Note:
* Measured in percent.

Source:
North Slope Borough, 1999.

Table III-20
Participation in Successful Resource Harvests by Percentage of Households in Barrow and Nuiqsut

[redacted]	[redacted]	[redacted]
Marine Mammals	76	37
Terrestrial Mammals	77	76
Fish	60	81
Birds	65	76
Bowhead Whale	75	5
Walrus	29	0
Bearded Seals	46	7
Ringed Seals	19	31
Spotted Seals	1	2
Polar Bear	7	2
Caribou	77	74
Moose	7	10
Brown Bear	0	8
Dall Sheep	3	0
Wolverine	1	16
Arctic Fox	5	13
Red Fox	*	23
Whitefish (all species)	54	74
Grayling	21	65
Arctic Char	5	31
Salmon (all species)	16	36
Burbot	10	57
Geese	40	73
Eiders	52	36
Ptarmigan	26	45

Total Households	87%	90%

Notes:
[1] Resources used from 1987-1990.
[2] Resources used in 1993.
* Less than 0.1%.

Sources:
S.R. Braund and Associates and UAA, ISER, 1993; Pedersen, 1995a, b; S.R. Braund and Associates, 1996.

Table III-21
1992 Point Lay Subsistence-Harvest Participation Rates and Resources

[illegible]	Often	Sometimes	[illegible]	Not At All	Often	Sometimes	[illegible]	Not at All
Fall Whaling	2	2	0	36	5	5	0	90
Fish	23	13	0	4	58	33	0	10
Helped Whaling Crew	9	5	0	26	23	13	0	65
Hunt Caribou	31	5	0	4	78	13	0	10
Hunt Moose, Bear or Sheep	6	13	1	20	15	33	3	50
Hunt Seal	24	6	0	10	60	15	0	25
Hunt Walrus	19	11	0	10	48	28	0	25
Hunt Waterfowl and Eggs	25	10	0	5	63	25	0	13
Make Sleds or Boats	12	18	0	10	30	45	0	25
Pick Berries	14	11	0	15	35	28	0	38
Sew Skins, Make Parkas	7	8	0	25	18	20	0	63
Spring Whaling	7	4	0	29	18	10	0	73
Trap	4	7	0	29	10	18	0	73

Note:
Households participating in survey (n = 40). Total househol[illegible].

Source:
Fuller and George, 1992.

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Table III-22
1989 Wainwright Subsistence-Harvest Summary

Total Marine Mammals	—[2]	243,595	2,047.01	520.50	78.0
Bowhead Whale	2	[illegible]	[illegible]	[illegible]	[illegible]
Pacific Walrus	153	118,370	994.71	252.93	37.0
Polar Bear	12	[illegible]	[illegible]	12.72	[illegible]
Bearded Seal	74	13,025	109.45	27.83	34.0
Ringed Seal	[illegible]	3,612	[illegible]	7.72	[illegible]
Spotted Seal	12	505	4.24	1.08	6.0
Terrestrial Mammals					
Large Land Mammals	713	83,387	700.73	178.18	66.0
Brown Bear	2	200	1.68	0.43	2.0
Caribou	711	83,187	699.05	177.75	66.0
Small Land Mammals/Furbearers	47	2	0.02	0.00	—
Arctic Fox	8*	0	0.00	0.00	6.0
Red Fox	22*	0	0.00	0.00	2.0
Land Otter	1*	0	0.00	0.00	1.0
Parka Squirrel	7	2	0.02	0.00	1.0
Weasel	9*	0	0.00	0.00	4.0
Wolf	2*	0	0.00	0.00	2.0
Wolverine	7*	0	0.00	0.00	2.0
Fish					
Total Fish	64,567	17,385	146.09	37.15	62.0
Total Salmon	[illegible]	1,044	8.77	2.23	7.0
Chum Salmon	68	415	3.49	0.89	4.0
Coho Salmon (silver salmon)	51	306	2.57	0.65	5.0
Chinook Salmon	9	162	1.36	0.35	4.0
Pink Salmon	52	161	1.35	0.34	4.0
Total Non-salmon	64,387	16,341	137.32	34.92	—
Saffron Cod	[illegible]	[illegible]	[illegible]	13.87	53.0
Pacific Tom Cod	134	134	1.13	0.29	1.0
Flounder	4	2	0.02	0.00	3.0
Sculpin	7	5	0.04	0.01	2.0
[illegible]	81	[illegible]	[illegible]	0.73	10.0
Grayling	3,006	2,405	20.21	5.14	28.0
Total Whitefish	7,102	7,102	[illegible]	15.18	23.0
Cisco	7,102	7,102	59.68	15.18	—
Bering Cisco	426	426	3.58	0.91	3.0
Least Cisco	6,676	6,676	56.10	14.26	22.0
Birds					
Total Birds and Eggs	2,735	7,211	60.60	15.41	57.0
Migratory Birds	[illegible]	[illegible]	[illegible]	[illegible]	—
Ducks	1,099	1,648	13.85	3.52	48.0
Eiders	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Common Eider	29	44	1.37	0.09	7.0
King Eider	[illegible]	[illegible]	[illegible]	2.82	[illegible]
Spectacled Eider	246	369	3.10	0.79	26.0
Steller's Eider	3	5	0.04	0.01	3.0

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Unknown Elder	3	5	0.04	0.01	1.0
[illegible]	2	4	[illegible]	[illegible]	[illegible]
Geese	1,436	5,425	45.59	11.58	45.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Canada Geese	2	10	0.08	0.02	1.0
Snow Geese	7	[illegible]	[illegible]	[illegible]	[illegible]
White fronted	730	3,286	27.61	7.02	29.0
Seabirds and Loons	1	4	[illegible]	[illegible]	[illegible]
Ptarmigan	196	137	1.15	0.29	15.0

Notes:

[1] Percentage of households participating in subsistence harvest.

[2] Not calculated in report.

* Not eaten.

Number of households in the sample = 119

Number of households in the community = 119.

— = Data not available

Source:

State of Alaska, Department of Fish and Game, 1995b, 1996.

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Table III-23
Annual Beluga Whale Harvest for Point Lay, Wainwright, and Barrow (1980-2001)

1980	[20] [1]	–	–
1981	[20] [1]	–	–
1982	28 [2]	–	–
1983	[20] [1]	–	–
1984	[20] [1]	–	–
1985	[20] [1]	–	–
1986	[20] [1]	–	–
1987	22 [3] [35] [4]	47	0
1988	40	3	0
1989	16	0	1
1990	62	0	0
1991	35	5	1
1992	24 [5]	0	0
1993	77	0	2
1994	56	0	5
1995	31	0	0
1996	41	0	2
1997	3	4	8
1998	48	38	1
1999	47	3	1
2000	0	0	1
2001	34	23	1

Notes:

[1] Average harvest 1980-1986; Lowry et al., 1989.

[2] Braund and Burnham, 1984.

[3] Data reported to the Alaska Beluga Whale Committee (ABWC) 2002.

[4] Data from interviews in the Point Lay Case Study, Impact Assessment, 1989.

[5] Fuller and George, 1997 ABWC 2002.

[ ] = estimate derived from interviews with residents.

– = Data not available.

Source:
ABWC, 2002.

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Table III-24
1987 Point Lay Subsistence-Harvest Summary

[illegible]	[illegible]	Total (lbs)	[illegible]	Per capita (lbs)	[illegible]
Marine Mammals					
Total Marine Mammals	—[3]	76,853	1,767.27	637.41	79.6
Beluga Whale	—	64,929*	1,509.98	538.52	74.0
Pacific Walrus	6	4,603	107.04	38.18	19.0
Polar Bear	1	661	15.38	5.48	3.1
Bearded Seal	13	2,341	54.44	19.42	26.7
Ringed Seal	49	2,078	48.32	17.23	27.0
Spotted Seal	53	2241	52.12	18.59	29.2
Terrestrial Mammals					
Large Land Mammals	167	21,309	495.56	176.74	71.8
Brown Bear	4	427	9.92	3.54	9.9
Caribou	157	18,418	428.33	152.76	71.8
Moose	5	2,464	57.31	20.44	15.6
Small Land Mammals/Furbearers	282	117	2.72	0.97	[illegible]
Arctic Fox	0	0	0.00	0.00	0.0
Red Fox	0	0	0.0	0.00	0.0
Marmot	0	0	0.00	0.00	0.0
Parka Squirrel	285	117	2.72	0.97	22.7
Weasel	0	0	0.00	0.00	0.0
Wolf	0	0	0.00	0.00	0.0
Wolverine	7*	0	0.00	0.00	6.5
Fish					
Total Fish	2,807	2,983	69.38	24.74	49.1
Total Salmon	147	425	9.88	3.52	26.4
Chum Salmon	40	242	5.64	2.01	19.5
Pink Salmon	107	182	4.24	1.51	16.4

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Total Nonsalmon	2,660	2,559	59.50	21.22	49.1
Herring	27	5	0.11	0.04	3.1
Smelt	265	37	0.86	0.31	6.8
Flounder	192	96	2.35	0.73	7.0
Arctic Char	167	552	12.83	4.58	23.3
Grayling	1,985	1,786	41.54	14.81	36.6
Broad Whitefish	24	83	1.92	0.69	5.6
[illegible]					
Total Birds and Eggs	3,531	5,836	135.73	48.40	77.4
Migratory Birds	1,871	5,327	123.88	44.18	77.4
Ducks	933	1,399	32.54	11.60	65.2
Eider	702	1,054	24.50	8.74	65.2
Oldsquaw	221	331	7.69	2.75	19.3
Pintail	10	15	0.34	0.12	5.6
Geese	3,944	16,289	17.38	5.40	13.0
Brant	499	2,096	48.73	17.38	55.9
Canada Geese	435	1,826	42.46	15.14	52.8
Seabirds and Loons	4	7	0.15	0.06	3.4
Murre	4	7	0.15	0.06	3.4
Ptarmigan	473	331	7.70	2.75	51.6
Eggs	1,188	178	4.14	1.48	54.2

Notes:

[1] Household harvests were unknown but were estimated from the known community harvest. This introduces an artificially high variance into the total pounds statistics.

[2] Percentage of households participating in subsistence harvest.

[3] Not calculated in report.

* Not eaten.

— Data not available.

Number of households in the sample (n = 25). Number of households in the community = 43.

Source:

State of Alaska, Department of Fish and Game, 1995b, 1996.

Table III-25
Annual Walrus Harvest for Point Lay, Wainwright, and Barrow (1982-2001)

1982	–	–	–
1983	10-15 [1]	–	–
1984	–	–	–
1985	–	–	–
1986	–	–	–
1987	6 [2]	–	54 [3]
1988	0	0 [59] [4]	1 [62] [5]
1989	0	43 [153] [6]	11 [101] [7]
1990	0	0	7
1991	0	32	23
1992	0	33 [82] [8]	22 [206] [9]
1993	1	44	31
1994	1	68	16
1995	4	83	10
1996	4	23	8
1997	0	48	35
1998	8	69	22

1999	8	48	17
2000	5	34	17
2001	3	65	–

Notes:

[1] Braund and Burnham, 1984.

[2] CPDB, 1996.

[3, 4, 5, 6, 7] Braund, 1993.

[8, 9] Fuller and George, 1997.

Some cells display two harvest numbers. Brackets indicate estimates derived from interviews with residents. The differences in harvest numbers are based on the differences in interview data vs. tagging data. Not all walrus ivory is tagged and there is always a discrepancy between tagged numbers based on reporting and harvested numbers based on interviews with hunters (Braund, 1993).

[ ] Indicate estimate derived from interviews with residents.

Source:
USDOI, Fish and Wildlife Service, 1997, 2002.

Table III-26
Annual Polar Bear Harvest for Point Lay, Wainwright, Barrow, and Nuiqsut (1983 to 2001)

[illegible]	Point Lay	[illegible]	[illegible]	[illegible]
1983/84	8	33	27	0
1984/85	0	18	31	1
1985/86	7	8	13	4
1986/87	1	13	21	5
1987/88	2	9	14	1
1988/89[3]	2	15	29 (30)	3 (2)
1989/90	1	9	14	0
1990/91	2	6	11	0
1991/92	2	3	22 (23)	2
1992/93	2	8	26	0
1993/94	1	10	27 (26)	5
1994/95	1	6	9 (11)	1
1995/96	1	14	19 (16)	1
1996/97	6	8	39 (32)	0
1997/98	3	6	17 (15)	2
1998/99	0	2	16 (11)	3 (2)
1999/00	3	4	18 (13)	7 (5)
2000/01	1	10	25	4

Key:

[1] Harvest season is July 1 to June 30.

[2] Numbers are reported number of bears harvested annually. Numbers in parentheses are number of bear tags actually collected by FWS annually.

[3] Atqasuk also harvested 2 bears during the 1988/89 season.

Sources:
Schliebe, Amstrup, and Garner.

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Table III-27
Annual Bowhead Whale Subsistence Harvest for Wainwright, Barrow, and Nuiqsut (1982-2001).

[illegible]	[illegible]	[illegible]	[illegible]
1982	2	0	1
1983	2	2	1
1984	2	4	0
1985	2	5	1[3]
1986	3	8	1
1987	4	7	1
1988	4	11	0
1989	2	10	2
1990	4	11	1
1991	4	13	2
1992	0	22	2
1993	4 + 1 stinker	6	3
1994	4	16	0
1995	5	16	4
1996	3	24	2
1997	3	30	3
1998	3	25	4
1999	5	24	3
2000	5	18	4
2001	6	28	3

Notes:

[1] Atqasuk whalers participated in the subsistence bowhead hunt by joining Barrow whaling crews.

[2] Before 1982 most Nuiqsut hunters who wanted to hunt whales went spring whaling with one of the other coastal villages.

[3] According to ADF&G (1993a), two Nuiqsut households worked on a successful Barrow whaling crew and received shares equivalent to one-tenth of a whale each (whale weight = 19,625 lbs).

Sources:
Stoker, 1983, as cited in ACI/Braund, 1984; State of Alaska, Dept. of Fish and Game, 1993a,b; George et al., 1993; Gusey, 1993; Philo et al., 1994; Stoker and Krupnik, 1993; Alaska Eskimo Whaling Commission, 1993, 1994, 1995; S.R. Braund and Associates, 2002; Impact Assessment, Inc., 1990a.

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Table III-28
Species Harvested by Barrow Residents (1987-1990)

	Year 1	Year 2	Year 3	3-Year Average
Bowhead whale	7	11	10	9
Pacific Walrus	84	61	101	81
Bearded Seal	236	179	109	174
Ringed Seal	466	388	328	394
Spotted Seal	2	4	4	3
Polar Bear	12	11	39	21
Beluga Whale	0	0	0	0
Caribou	1,595	1,533	1,658	1,595
Moose	52	53	40	48
Dall Sheep	12	12	9	11
Brown Bear	1	1	0	1
Porcupine	5	0	0	2
Ground Squirrel	24	0	17	14
Wolverine	4	2	1	2
Arctic Fox	192	146	48	129
Red Fox	8	4	2	5
Wolf	0	0	0	0
Ermine	0	0	0	0
Whitefish	27,366	20,628	38,053	28,683
Nonspecified	5,108	173	0	1,760
Round	2,122	721	16	953
Broad-rivers/lakes	10,579	11,431	30,047	17,352
Humpback	1,225	647	3,648	1,840
Least Cisco	7,024	7,505	2,929	5,819
Arctic Cisco	1,309	151	1,413	958
Grayling	12,664	8,684	8,392	9,914
Arctic Char	38	76	135	83
Burbot	1,086	392	[illegible]	676
Lake Trout	153	72	216	147
Northern Pike	2	0	10	4
Salmon	196	80	2,089	788
Nonspecified	66	3	439	169
Chum	11	5	529	182
Pink	12	1	261	[illegible]
Silver	103	70	828	334
King	4	1	31	12
Capelin	3,960	0	346	1,435
Rainbow Smelt	97	0	1,480	526
Arctic Cod	0	7,945	17,018	8,321
Arctic Flounder	0	0	0	0
Tomcod	0	194	0	65
Sculpin	0	11	0	4
Geese	2,873	3,334	3,943	3,384
Nonspecified	329	69	34	144
Brant	127	221	973	440
White-Fronted	2,417	3,036	2,892	2,782

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	Year 1	Year 2	Year 3	3-Year Average
Snow	0	8	4	4
Canada	0	1	1	1
Eiders	5,173	4,499	8,590	6,087
Ptarmigan	2,454	1,350	329	1,378
Other Birds	79	0	9	30

Source:
Adapted from S.R. Braund and Associates, 1993b.

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Table III-29
1989 Barrow Subsistence-Harvest Summary

Subsistence Resource	[illegible]	Total (lbs)	Household Harvest (mean lbs)	Per capita (lbs)	[illegible]
Marine Mammals					
Total Marine Mammals	591	506,181	542.35	166.50	45.0
Bowhead Whale	10	377,847	403.04	125.21	45.0
Beluga Whale	0	0	0.00	0.00	0.0
Pacific Walrus	101	77,687	83.23	25.55	13.0
Polar Bear	39	19,471	20.78	6.46	4.0
Bearded Seal	109	19,152	20.44	6.28	11.0
Ringed Seal	328	13,774	14.70	4.57	11.0
Spotted Seal	4	151	0.16	0.05	–
Terrestrial Mammals					
Large Land Mammals	1,705	214,676	229.11	71.18	39.0
Brown Bear	0	0	0.00	0.00	0.0
Caribou	1,656	193,744	206.77	64.24	39.0
Moose	40	20,014	21.38	6.64	6.0
Dall Sheep	9	918	0.98	0.30	2.0
Small Land Mammals/Furbearers	68	7	0.01	0.00	2.0
Arctic Fox	48*	0	0.00	0.00	–
Red Fox	2*	0	0.00	0.00	–
Marmot	0	0	0.00	0.00	0.0
Mink	0	0	0.00	0.00	0.0
Parka Squirrel	17	7	0.01	0.00	x
Weasel	0	0	0.00	0.00	0.0
Wolf	0	0	0.00	0.00	0.0
Wolverine	1	0	0.00	0.00	x
Fish					
Total Fish	68,287	118,471	126.44	39.28	61.0
Total Salmon	2,088	12,244	13.07	4.06	10.0
Total Non-salmon	66,199	106,226	113.37	35.22	13.0
Smelt	1,825	247	0.26	0.08	2.0
Cod	17,018	3,404	3.63	1.13	5.0
Burbot	550	2,202	2.35	0.73	7.0
Char	350	1,239	1.32	0.41	5.0
Grayling	6,393	6,714	7.17	2.23	9.0
Total Whitefish	38,054	92,399	98.61	30.64	18.0
Broad Whitefish	30,947	78,921	84.23	26.17	–
Cisco	2,929	2,929	3.13	0.97	3.0
Humpback Whitefish	3,646	9,119	9.73	3.02	10.0
Birds					
Total Birds and Eggs	12,869	29,446	31.43	9.76	41.0
Migratory Birds	12,539	29,215	31.18	9.69	37.0
Ducks	8,589	12,883	13.75	4.27	37.0
Eiders	8,585	12,877	13.74	4.27	37.0
Long-Tailed Duck	2	4	0.00	0.00	0.0
Goose	3,944	16,289	17.38	5.40	13.0

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Snow Geese	4	19	0.02	0.01	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seabirds and Loons	3	9	0.01	0.00	x
[illegible]	[illegible]	231	[illegible]	[illegible]	5.0
Bird Eggs	–	–	–	–	–

Notes:

[1] Percentage of households participating in subsistence harvest.

* Not estim.

* Percent harvested = less than 0.1%.

– Data not available.

Number of households in sample (n=101). Number of households in the community = 937.

Table III-30
1988 Atqasuk Subsistence Participation Levels by Household [1]

[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
Inupiat HH's		28,250	17,500	30,558	—
Non-Inupiat HH's		85,000	57,500	45,000	—
All HH's		43,529	27,500	32,000	36,431
Cases		17	4	20	41
Average HH Size (# Persons per HH)					
Inupiat HH's		4.2	4.5	4.8	—
Non-Inupiat HH's		3.2	2.0	2.0	—
All HH's		3.9	4.0	4.6	4.3
Cases		17	5	23	45
Average Meat & Fish Consumption From Own HH Subsistence (by percent)					
Inupiat HH's		13.8	35.0	78.1	—
Non-Inupiat HH's		6.0	25.0	75.0	—
All HH's		11.5	33.0	77.8	47.8
Cases		17	5	23	45
Average Meat & Fish Consumption From Other HH Subsistence (by percent)					
Inupiat HH's		12.9	5.0	17.7	—
Non-Inupiat HH's		0.0	0.0	0.0	—
All HH's		9.1	4.0	20.5	14.4
Cases		17	5	23	45
Average Meat & Fish Harvested And Given Away (by percent)					
Inupiat HH's		5.4	10.0	18.3	—
Non-Inupiat HH's		2.0	0.0	45.0	—
All HH's		4.4	8.0	20.7	13.1
Cases		17	5	23	45
Average Proportion of HH Income Spent In Village (by percent)					
Inupiat HH's		77.5	62.5	82.6	—
Non-Inupiat HH's		13.0	25.0	65.0	—
All HH's		58.5	55.0	81.1	69.7
Cases		17	5	23	45

Notes:

[1] Total available households = 55.

[2] Degree of subsistence participation based on how much meat and fish consumed from own household subsistence activity. Levels of subsistence defined as:

Minimal = under 20% meat and fish from own HH subsistence.

Moderate = 20% to 40% meat and fish from own HH subsistence.

Active = over 40% meat and fish from own HH subsistence.

Key:

HH = Household Harvest.

Source:
Adapted from: Impact Assessment, Inc., 1990, citing North Slope Borough, Department of Planning and Community Services, Census of Population.

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Table III-31
Atqasuk Subsistence Harvest by Month (July 1, 1994 to June 30, 1995)

[illegible]	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	[illegible]	[illegible]
Arctic Char	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Arctic Cisco	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Broad Whitefish	0	100	1,050	130	0	0	0	0	0	0	0	350	1,630	1,790
Burbot	0	0	10	130	22	0	0	0	0	0	0	0	162	178
Rainbow Trout	0	0	0	15	0	0	0	0	0	0	0	0	15	16
Grayling	100	850	2,078	2,463	225	0	0	0	0	0	0	0	5,716	6,276
Silver Salmon	0	0	0	10	0	0	0	0	0	0	0	0	10	11
Humpback Whitefish	0	13	150	112	150	0	0	0	0	0	0	75	500	549
Least Cisco	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Whitefish Unidentified	0	88	100	1,087	125	0	0	0	0	0	0	0	1,400	1,537
Caribou	31	43	43	25	22	7	1	9	2	0	3	1	187	205
Moose	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Wolf	0	0	0	1	0	0	0	0	1	0	0	0	2	2
Wolverine	0	0	0	0	3	0	0	4	3	0	0	0	10	11
Arctic Fox	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Ground Squirrel	0	0	0	0	0	0	0	0	0	0	6	0	6	7
Red Fox	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Geese Unidentified	0	0	0	0	0	0	0	0	0	0	168	0	168	184
Eider Unidentified	0	0	0	0	0	0	0	0	0	0	12	0	12	13
White fronted Goose	0	0	0	0	0	0	0	0	0	0	76	0	76	83
Canada Goose	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Brant	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Ptarmigan	0	0	0	0	0	0	0	0	0	0	16	0	16	18
Ringed Seal	4	0	0	0	0	0	0	0	0	0	0	0	4	4
Bearded Seal	4	0	0	0	0	0	0	0	0	0	0	0	4	4
Salmonberries (gallon)	0	72	0	0	0	0	0	0	0	0	0	0	72	79
Cranberries (gallon)	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Blueberries (gallon)	2	0	10	0	0	0	0	0	0	0	0	0	12	13

Source: Opie, Bower, and Bates 1997.

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Table III-32
1993 Nuiqsut Subsistence-Harvest Summary

[illegible]	[illegible]	[illegible] Total (lbs)	[illegible]	[illegible]
Marine Mammals				
Total Marine Mammals	113	85,216	936.44	236.01
Bowhead Whale	**3**	**76,908**	**845.12**	**213**
Polar Bear	1*	0	0.00	0.00
Bearded Seal	**6**	**1,033**	**11.35**	**2.86**
Ringed Seal	98	7,277	79.96	20.15
Spotted Seal	**4***	**0**	**0.00**	**0.00**
Terrestrial Mammals				
Large Land Mammals	691	87,306	959.40	241.80
Brown Bear	**10***	**734**	**8.07**	**2.03**
Caribou	672	82,169	902.95	227.57
Moose	**9**	**4,403**	**48.38**	**12.19**
Muskox	0	0	0.00	0.00
Dall Sheep	**0**	**0**	**0.00**	**0.00**
Small Land Mammals/Furbearers	599 *	84	0.92	0.23
Arctic Fox	**203**	**0**	**0.00**	**0.00**
Red Fox	63	0	0.00	0.00
Marmot	**0**	**0**	**0.00**	**0.00**
Mink	0	0	0.00	0.00
Parka Squirrel	**336**	**84**	**0.92**	**0.23**
Weasel	10	0	0.00	0.00
Wolf	**31**	**0**	**0.00**	**0.00**
Wolverine	19	0	0.00	0.00
Fishes				
Total Fish	71,898	90,490	994.39	250.62
Total Salmon	**272**	**1,009**	**11.08**	**2.79**
Total Non-salmon	71,626	89,481	983.30	247.83
Smelt	**304**	**42**	**0.46**	**0.12**
Cod	62	7	0.07	0.02
Burbot	**1,416**	**5,948**	**65.37**	**16.48**
Char	618	1,748	19.20	4.84
Grayling	**4,515**	**4,063**	**44.65**	**11.25**
Total Whitefish	64,711	77,671	853.53	215.12
Cisco	**51,791**	**34,943**	**383.98**	**96.78**
Arctic Cisco	45,237	31,666	347.97	87.70
Least Cisco	**6,553**	**3,277**	**36.00**	**9.08**
Birds				
Total Birds and Eggs	3,556	4,325	47.53	11.98
Migratory Birds	**2,238**	**3,540**	**38.90**	**9.80**
Ducks	772	1,152	12.66	3.19
Eiders	**662**	**1,059**	**11.64**	**2.93**
Geese	1,459	2,314	25.43	6.41
Brant	**288**	**356**	**3.91**	**0.99**
Canada Goose	691	830	9.11	2.30
White-fronted	**480**	**1,128**	**12.40**	**3.12**
Swan	7	73	0.80	0.20

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[illegible]	[illegible]	Total (lbs)	Household Harvest (Mean lbs)	Per capita (lbs)
Ptarmigan	873	[illegible]	[illegible]	[illegible]

Notes:
* Not eaten.
* Some not eaten.
Number of households in sample = 62. Number of households in the community = 91.

Source:
State of Alaska, Dept. of Fish and Game, 1995b.

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Table III–33
Nuiqsut Subsistence Harvest by Month (July 1, 1994 to June 30, 1995)

[illegible]	[illegible]						[illegible]						[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]														
Arctic Char	0	8	0	0	0	0	0	0	0	0	0	0	8	8
Arctic Cisco[1]	0	0	37	5,737	2,400	1,050	262	0	0	0	0	0	9,486	9,842
Broad Whitefish	1,535	25	75	855	500	0	0	0	0	0	0	130	3,120	3,237
Burbot	0	0	0	9	76	3	0	0	0	0	0	0	88	91
Fish Unidentified	0	0	0	0	0	0	0	0	0	0	0	75	75	78
Grayling	0	24	225	110	84	0	0	0	0	0	0	2	445	462
Humpback Salmon	10	0	0	0	0	0	0	0	0	0	0	0	10	10
Humpback Whitefish[1]	0	0	0	150	25	0	0	0	0	0	0	0	175	182
Least Cisco	0	0	0	0	0	750	0	0	0	0	0	0	750	778
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	18	18	19
Whitefish Unidentified	0	0	0	50	425	0	0	0	0	0	0	0	475	493
[illegible]														
Caribou	63	32	6	80	13	4	9	5	13	7	2	15	249	258
Moose	1	1	1	1	0	0	1	0	0	0	0	0	5	5
Wolf	0	0	0	0	1	1	3	0	12	1	0	0	18	19
Wolverine	0	0	0	0	1	1	2	1	1	2	0	0	8	8
[illegible]														
Arctic Fox	0	0	0	0	0	1	1	1	3	0	0	0	6	6
Fox Unidentified	0	0	0	0	4	0	0	0	0	0	0	0	4	4
Red Fox	0	0	0	0	0	1	1	1	1	1	0	0	5	5
[illegible]														
Polar Bear	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Ringed Seal	2	10	0	0	0	0	0	0	0	6	0	5	23	24
[illegible]														
Tundra Swan	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Geese Unidentified	0	0	0	0	0	0	0	0	0	0	409	48	457	474
Eider Unidentified	0	0	0	0	0	0	0	0	0	0	50	40	90	93
Ptarmigan	0	0	0	0	0	0	0	0	0	33	23	0	56	58
Sandhill Crane	0	0	0	0	0	0	0	0	0	0	0	1	1	1
[illegible]														
Salmonberries (gallon)	0	9	0	0	0	0	0	0	0	0	0	0	9	9
Cranberries (gallon)	0	0.5	—	0	0	0	0	0	0	0	0	0	0.5	1
Blueberries (gallon)	0	2.5	—	0	0	0	0	0	0	0	0	0	2.5	3
Blackberries (gallon)	0	0.5	—	0	0	0	0	0	0	0	0	0	0.5	1

Notes:

[1] The harvest of arctic cisco and humpback whitefish is underrepresented: one household provided evidence of a significant but unquantifiable harvest by saying that "sled loads" were harvested "every couple of days during October and November."

Sources: Brower and Opie, 1997; Brower and Hepa, 1998.

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Table III-34
Status of Entitlements for Atqasuk, Barrow, and Wainwright

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Atqasuk Entitlements					
12(a)	69,120	0.00	56,744	14,111.46 [1]	1,391
12(b)	3,834	0.00	0.00	3,834	0.00
Barrow Entitlements					
12(a)	6	140,862.65 [2]	18,842.49 [3]	935.35 [3]	0.00
12(b)	54,530	54,530	–	0.00	0.00
Wainwright Entitlements					
12(a)	115,200	0.00	111,429.34 [4]	3,770.66 [5]	4,041.10
Technical Corrections Act of 1992 Replacement Lands	**2,713.81**	**0.00**	**0.00**	**2,713.81**	**5,110.00**
12(b)	55,670.12	–	55,670.12	0.00	0.00

Notes:

[1] A total of 1,735.46 acres was credited for the title recovery of Native Allotments. This is added to the remaining entitlement figure in the above table. The Federal Government currently owns the subsurface estate.

[2] Pursuant to the NARL Agreement, this figure represents Barrow's full entitlement for 12(a).

[3] Based upon the Technical Corrections Act of 1992, an acreage credit of 935.35 acres occurred as a result of the title recovery actions. Barrow also received the subsurface estate for sand and gravel on 68,053 acres for surface acres selected by ASRC under the Gas Field Transfer Act. At present, the Federal Government owns the subsurface, excluding sand and gravel and natural gas, under the village-selected lands and conveyed lands in the Barrow area.

[4] This had 2,713.81 acres subtracted for the title recovery of Native Allotments that are being replaced per the Technical Corrections Act of 1992.

[5] This total will have 39.99 acres added once the Native Allotment title recoveries are complete for F-15473 Parcel D.

Table III-35
NW NPR-A Wilderness Units and Acreage

Wilderness Unit	Acres[1]
(A) Peard River	979,560
(B) Chipp River	1,714,627
(C) Meade River	1,622,443
(D) Kuk River	978,171
(E) Icy Cape	261,078
(F) Mountains	2,051,289
(G) Foothills	737,526

Note:
[1] Public lands that have wilderness characteristics

Table III-36
Scenic Quality Ratings for NW NPR-A

[illegible]	[illegible]	[illegible]	[illegible]
SQ01	Coastline	Chukchi Coast	Class B [1]
SQ02	Coastline	Elson Lagoon and Dease Inlet	Class B
SQ03	Coastline	Beaufort Sea Coast	Class C [2]
SQ04	Coastline	Barrow	Class C
SQ05	Wet Plains	Large Water Bodies	Class C
SQ06	Wet Plains	Oriented Lakes	Class B
SQ07	Wet Plains	Remaining Wet Plains	Class C
SQ08	Plains	Dry Plains	Class C
SQ10 [3]	Ridges	Eastern Portion	Class C
SQ12 [3]	Colville River Valley	Middle Colville	Class A [4]

Notes:

[1] Class B SQRU has a moderate amount of visual variety, contrast, and harmony.
[2] Class C SQRU has little visual variety, contrast, and harmony.
[3] These units are correctly identified from the 105c Study as applied to the Planning Area.
[4] Class A SQRU has a great deal of visual variety, contrast, and harmony.

Key:
SQ = Scenic Quality.

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Table III-37
Land Use Sensitivity Levels for NW NPR-A

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Inholdings and Camps	H	L	M	L	L	–	L
River Routes	H	M	H	L	L	–	M
Transportation Corridors	H	L	H	L	L	–	M
Coastal Plain	H	M	H	L	L	–	M

Key:
Use = Type of use.
#Use = Amount of use.
PI = Public Interest.
Adj = Adjacent land use.
SA = Special Area.
OF = Other Factors.
OR = Overall Rating.
H = High.
M = Medium.
L = Low.

Source:
Visual Resource Inventory BLM Manual Handbook 8410-1.

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Table III-38
Rivers in NW NPR-A Eligible for Designation as Wild and Scenic

Alataktruk	(Kuk tributary) Subsistence, Fisheries, Wildlife
Alaktak	Subsistence, Fisheries, Wildlife
Avak	Essential to ecological function of the largest lagoon and barrier beach system in the North American Arctic.
Avalik	(Kuk tributary) Subsistence, Fisheries, Wildlife
Chipp	Subsistence, Fisheries, Wildlife
Colville	Recreation, Wildlife Viewing, Geology, Archeology
Inaru	Subsistence
Ivisaruk	(Kuk tributary) Subsistence, Fisheries, Wildlife
Kaolak	(Kuk tributary) Subsistence, Fisheries, Wildlife
Ketik	(Kuk tributary) Subsistence, Fisheries, Wildlife
Kigalik	Cultural
Kuk	Subsistence, Fisheries, Wildlife, Cultural
Kungok	(Kuk tributary) Subsistence, Fisheries, Wildlife
Meade	Subsistence, Fisheries, Wildlife
Nokotlek	Essential to ecological function of the largest lagoon and barrier beach system in the North American Arctic.
Ongoravik	Essential to ecological function of the largest lagoon and barrier beach system in the North American Arctic.
Oumalik	Subsistence, Fisheries, Wildlife
Titaluk	Subsistence, Fisheries, Wildlife
Topogoruk	Subsistence, Fisheries, Wildlife
Tunalik	Essential to ecological function of the largest lagoon and barrier beach system in the North American Arctic.
Usuktuk	Subsistence, Fisheries, Wildlife
Maybe Creek	Cultural

Note:

[1] BLM has identified the appropriate classification as "scenic" because of the level of development (mainly subsistence cabins and camps), although this does not mean that scenery is an Outstandingly Remarkable Value (ORV). In fact, none of the eligible rivers in the Planning Area have scenery as an ORV. Refer to Section III.C.10 for more detailed descriptions of the values and potential restrictions on development that are required to protect rivers.

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Table III-39
Economic Oil and Gas Resources in NPR-A
Undiscovered, Risked, Economically Recoverable Resources

Play No.	Name	[illegible] Resources [illegible] + [illegible] NPR-A [illegible]		[illegible]		[illegible]	[illegible]			
		$18 Oil price	$30 Oil price	$2.88 Gas price	$4.27 Gas price	—	$18 Oil price	$30 Oil price	$2.88 Gas price	$4.27 Gas price
1	Endicott-BA	0.004	0.256	0.004	0.433	0.19	0.001	0.049	0.001	0.082
2	Endicott-AP	—	—	—	—	1.00	—	—	—	—
3	Ellesmerian gas	—	—	—	0.005	0.71	—	—	—	0.004
4	Lisburne-BA	—	0.047	0.001	0.081	0.00	—	—	—	—
5	Lisburne-AP	—	—	—	—	1.00	—	—	—	—
6	Sadlerochit-BA-east	0.017	0.286	0.019	0.495	0.46	0.008	0.132	0.009	0.228
7	Sadlerochit-AP-east	—	—	—	—	1.00	—	—	—	—
8	Beaufortian-BA-east	0.113	4.184	0.188	8.689	0.30	0.034	1.255	0.056	2.607
9	Beaufortian-AP-east	—	0.016	—	0.257	0.46	—	0.007	—	0.118
10	Beaufortian gas	—	—	—	—	1.00	—	—	—	—
11	Brookian turbidites-east	—	0.158	—	0.755	0.35	—	0.055	—	0.264
12	Brookian gas	—	—	—	—	1.00	—	—	—	—
13	Brookian topset-east	—	0.014	—	0.073	0.36	—	0.005	—	0.026
14	Brookian foldbelt	—	0.539	—	3.350	0.80	—	0.431	—	2.680
15	Sag River/Shublik-west	—	—	—	—	0.10	—	—	—	—
16	Sadlerochit-AP-west	—	—	—	—	1.00	—	—	—	—
17	Beaufortian-BA-west	—	0.002	—	0.040	0.70	—	0.001	—	0.028
18	Beaufortian-AP-west	—	—	—	—	1.00	—	—	—	—
19	Brookian turbidites-west	—	—	—	—	0.90	—	—	—	—
20	Brookian topset-west	—	—	—	—	0.90	—	—	—	—
21	Endicott/Lisb thrust belt	—	—	—	—	0.00	—	—	—	—
22	Beaufort detached fold	—	—	—	—	1.00	—	—	—	—
23	Fortress Mountain	—	0.195	—	1.652	0.77	—	0.150	—	1.272
Total		0.134	5.697	0.212	15.830	—	0.043	2.085	0.066	7.309
Percent of total		—	—	—	—	—	31%	37%	31%	46%

Notes:

BA	= Barrow Arch.
AP	= Arctic Platform.
Bbbl	= Billion barrels.
NE	= Northeast.
NW	= Northwest.
NPR-A	= National Petroleum Reserve-Alaska
Tcf	= Trillion cubic feet

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Table III-40
Field Survey Data for Rivers in NW NPR-A

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]								
1	Inaru River near the mouth	70.7842	157.0747	32	Coastal Plain	Sand	Grass/Tundra	20,000	11.6	398	34
2	Meade River below Nigisaktuvik River	70.6772	156.9933	37	Coastal Plain	Sand	Grass/Tundra	65,000	10.3	1,276	124
3	Meade River above Agulirock Creek	70.1942	157.0689	115	Coastal Plain	Sand/Gravel	Grass/Willows	50,000	13.4	835	62
4	Nigisaktuvik River	70.3628	158.1006	40	Coastal Plain	Sand	Grass/Willows	4,000	5.8	210	36
5	Usuktuk River	70.2561	156.8130	52	Coastal Plain	Sand	Grass/Tundra	25,000	9.3	400	43
6	Lower Topagoruk River	70.4181	155.8111	61	Coastal Plain	Sand	Grass/Tundra	50,000	11.9	620	52
7	Upper Topagoruk River	69.9925	156.1378	127	Foothills	Gravel/Cobbles	Willows	6,000	7.9	119	15
8	Lower Oumalik River	70.3086	155.1139	14	Coastal Plain	Sand	Grass/Tundra	25,000	9.3	400	43
9	Upper Oumalik River	69.8581	155.3822	110	Foothills	Sand	Willows	10,000	11.6	135	12
10	Chipp River	70.3444	154.9294	61	Coastal Plain	Sand	Grass/Tundra	ND	10	450	46
11	Alaktak River	70.5175	155.0194	38	Coastal Plain	Sand	Grass/Tundra	ND	6.8	358	53
12	Ikpikpuk River below Chipp River	70.3644	154.8689	48	Coastal Plain	Sand	Grass/Tundra	ND	11.1	1,154	104
13	Ikpikpuk River below Fry Creek	69.7669	154.6639	121	Foothills	Gravel/Cobbles	Willows	33,000	12.6	341	27
14	Ikpikpuk River above Bronx Creek	69.6163	154.8975	156	Foothills	Sand/Gravel	Willows	13,000	6.4	438	68
15	Bronx Creek	69.6577	155.0323	12	Foothills	Sand/Gravel	Willows	3,000	4.5	118	26
16	Lower Titaluk River	69.7822	155.1250	45	Foothills	Gravel/Cobbles	Grass/Willows	21,000	10.3	297	29
17	Upper Titaluk River	69.5293	155.7243	118	Foothills	Gravel/Cobbles	Willows	20,000	10.1	233	23
18	Kigalik River	69.2498	154.9710	67	Foothills	Gravel/Cobbles	Willows	16,000	9.2	197	21
19	Upper Maybe Creek	69.2475	153.9833	22	Foothills	Sand/Gravel	Willows	4,000	5.1	135	26
20	Ikpikpuk River below Titaluk River*	70.1367	154.6417	75	Coastal Plain	Sand	Grass/Willows	45,000	8.1	1,120	138
21	Colville River above Killik River*	69.0033	153.9060	184	Foothills	Gravel/Cobbles	Willows	200,000	12.8	1,460	114
22	Meade River at Atqasuk*	70.4888	157.4111	65	Coastal Plain	Sand/Gravel	Grass/Willows	8,700	3.8	470	124

Notes:
cfs = Cubic feet per second.
ft = Feet.
ND = Not Determined.

Sources:
BLM Field Surveys 2001-2002.
*Childers et al., 1979.

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Table IV-01
Projected North Slope Oil Production and World Crude Oil Prices

2000	1.045	26.22
2005	1.084	21.31
2010	0.961	21.86
2015	0.888	22.39
2020	0.723	22.93
2025	0.509	23.49
2030	0.315	24.05
2034	0.208	24.52

Notes:

[1] U.S. Dept. of Energy, 2001a, in USDOI, BLM, 2002.

[2] Derived from the U.S. Dept. of Energy Annual Energy Outlook forecast (U.S. Dept. of Energy, 2001b). Prices are deflated by using the domestic product implicit price deflator (Bureau of Economics Analysis, 2001).

Key:
$/bbl = Dollars per barrel.
MMbpd = Million barrels per day.

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Table IV-02
Exploration and Hypothetical Development Schedule for the First Commercial Oil Project in Northwest NPR-A

Year	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev	Expl[1]	Expl[2]/ Dev
2002	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2003	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2004	Sale	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2005	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
2006	1	1	–	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–
2007	1	1	1	2	1	2	–	–	–	–	–	–	–	–	–	–	–	–
2008	1	2	–	2	1	2	–	–	–	–	–	–	–	–	–	–	–	–
2009	–	2	–	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–
2010	1	2	1	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–
2011	1	2			1	2	–	–	–	–	–	–	–	–	–	–	–	50
2012	–	2	–	–	–	2	–	1	–	–	–	–	–	–	–	–	–	50
2013	1	2	–	–	1	2	–	1	–	12	–	1	–	–	–	19	–	35
2014	–	1	–	–	–	1	–	1	–	36	–	2	–	–	–	28	–	–
2015	–	–	–	–	–	–	–	–	–	36	–	2	–	–	–	38	–	–
2016	–	–	–	–	–	–	–	–	–	36	–	2	–	–	–	38	–	–
2017	–	–	–	–	–	–	–	–	–	20	–	2	–	–	–	38	–	–
2018	–	–	–	–	–	–	–	–	–	10	–	1	–	–	–	38	–	–
2019	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34	–	–
2020	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30	–	–
2021	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	26	–	–
2022	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23	–	–
2023	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20	–	–
2024	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18	–	–
2025	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16	–	–
2026	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14	–	–
2027	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	13	–	–
2028	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12	–	–

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[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev	Expl[1]	Expl[2] Dev
2029	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	–	–
2030	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9	–	–
2031	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	–	–
2032	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–
2033	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–
2034	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–
2035	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2036																		
Totals	6	16	2	6	6	17	0	3	–	150	0	10	1		0	450	0	135

Notes:

[1] Exploration only. This reflects an $18/bbl of oil scenario.

[2] Exploration and Development. This reflects a $30/bbl of oil scenario.

- The assumptions used in the above table are:
- Table reflects two levels of activity. The initial level represents oil and gas exploration corresponding to prices at or below $18/bbl of oil and $2.56/Mcf of gas. Commercial development would not be economic at these low prices in the high-cost area of Northwest NPR-A.
- The second level of activity represents the development schedule for the first commercial oil project discovered as a result of the 2004 lease sale.
- Exploration well totals include both dry wells and discoveries.
- Rig totals are maximum number operating in any single year.
- Production to service well ratio is 1:1.
- It is assumed that gas associated with oil recovery will be reinjected until a major transportation system is constructed to move the gas from the North Slope.
- A likely staging base is in the coastal area near Smith Bay.
- Peak production rates are given as millions of barrels per year.
- Pipeline miles do not include in-field flow lines: only sales oil gathering lines to the KRU. Pipeline miles are for right-of-way corridors that could include several individual pipelines (sales-oil, gas, product/fuel, seawater).

Key:

-- = Not applicable.
Expl = Exploration.
Dev = Development.
KRU = Kuparuk River Unit.

Table IV-03
Development Timeframe for a Typical Oil Field

Exploration	1 to 10	• seismic surveys to define prospects • well-site surveys and permitting • drill exploration wells
Discovery	1 to 4	• produceable well determination • drill delineation well(s) • additional seismic survey (3-D) • reservoir appraisal and engineering studies • project design and environmental studies • permit applications
Development	3 to 6	• establish construction base camp • set up environmental monitoring programs • install gravel pads for facilities • design and build production modules • begin drilling development wells • install pipelines and pump stations • install production facilities and hookup
Production	10 to 30	• continue development-well drilling • production ramp-up (2 to 5 years) • peak production plateau (3 to 8 years) • production declines • well workovers (every 3 to 5 years) • infill drilling (well spacing reduced) • tertiary recovery methods employed • wells progressively shut in • economic limit reached
Abandonment	2 to 5	• plug and abandon wells • remove production equipment • dismantle facilities • decommission pipeline • site restoration and revegetation • phase out environmental monitoring

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Table IV-04
Resource[1] Estimates for the First Sale under each Alternative[2]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	0	735	2.55	5
B	0	630	2.20	4
C	0	0	0	0
PA	0	630	2.20	4
FEP[5]	0	1,050	3.65	7

Notes:

[1] Resources are economic oil and gas pools expected to be leased, discovered, developed, and produced as a result of the next lease sale in the Northwest NPR-A Planning Area.

[2] Assumes that 50% of economic resources are leased and discovered as a result of the first sale.

[3] Assumes that 2/3 of the economic gas resources is associated with oil and 1/3 is in non-associated gas pools.

[4] Number of fields includes both large stand-alone fields with processing facilities and satellite fields that share facilities.

[5] Full Economic Potential is not analyzed as an alternative in the IAP/EIS, but is presented in this table as additional information.

Key:

PA = Preferred Alternative
FEP = Full Economic Potential
Mcf = Thousand cubic feet
MMbbl = Million barrels
Tcf = Trillion cubic feet

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Table IV-05

Activities for the First Sale under each Alternative (at Low[1] and High[1] per/bbl Prices)[6]

Alternative	Exploration Wells[2]		Delineation Wells		Exploration/ Delineation Rigs[3]		Production Pads		Production and Service Wells[4]		Production [illegible]		Staging Bases[5]		Peak Oil Production (MMbbl)		[illegible]
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	[illegible]
A	6	16	2	24	1	4	0	8	0	270	0	6	1	2	0	59	128
B	5	12	2	18	1	3	0	6	0	232	0	4	1	2	0	50	110
C	1	4	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0
PA	5	12	2	18	1	3	0	6	0	232	0	4	1	2	0	50	110
FEP[7]	8	22	2	34	1	4	0	10	0	386	0	8	1	2	0	68	146

Notes:

[1] Low is $18/bbl; high is $30/bbl.
[2] Exploration well totals include both dry wells and discoveries.
[3] Rig totals are maximum number operating in any single year.
[4] Production-to-service well ratio is 2:1.
[5] Staging bases are on the northern coast and Umiat.
[6] See Table IV-29 for pipeline corridor information.
[7] Full Economic Potential (FEP) is not analyzed as an alternative in the IAP/EIS, but is presented in this table as additional information.

Key:

PA = Preferred Alternative
FEP = Full Economic Potential
MMbbl = Million barrels
Bcf/yr = Billion cubic feet per year

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Table IV-06
Resource[1] Estimates for all Sales under each Alternative[2]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	0	1,470	5.10	0 - 10
B	0	1,260	4.40	0 - 8
C	0	0	0	0
PA	0	1,260	4.40	0 - 8
FEP[5]	0	2,100	7.30	0 - 14

Notes:

[1] Resources are economic oil and gas pools expected to be leased, discovered, developed, and produced as a result of multiple lease sales in the Northwest NPR-A Planning Area.

[2] Assumes 100% of economic resources are leased and discovered as a result of multiple sales.

[3] Assumes that 2/3 of the economic gas resources is associated with oil and 1/3 is in non-associated gas pools.

[4] Number of fields includes both large stand-alone fields with processing facilities and satellite fields that share facilities.

[5] Full Economic Potential is not analyzed as an alternative in this IAP/EIS, but is presented in this table as additional information.

Key:

PA	= Preferred Alternative.
FEP	= Full Economic Potential.
Mcf	= Thousand cubic feet.
MMbbl	= Million barrels.
Tcf	= Trillion cubic feet.

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Table IV-07 Activities for All Sales under each Alternative (at Low[1] and High[1] per/bbl Prices)[6]

	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
A	18	48	6	48	1	3	0	16	0	540	0	12	1	3	0	59	128
B	15	36	6	36	1	3	0	12	0	464	0	8	1	3	0	50	110
C	3	12	2	4	1	2	0	0	0	0	0	0	0	0	0	0	0
PA	15	36	6	36	1	3	0	12	0	464	0	8	1	3	0	50	110
FEP[7]	24	72	8	64	1	3	0	22	0	772	0	16	1	3	0	68	146

Notes:

[1] Low is $18/bbl; high is $30/bbl.

[2] Exploration well totals include both dry wells and discoveries.

[3] Rig totals are the maximum number operating in any single year.

[4] Production-to-service well ratio is 2:1.

[5] Staging bases are on the northern coast and Umiat.

[6] See Table IV-29 for pipeline corridor information.

[7] Full Economic Potential (FEP) is not analyzed as an alternative in the IAP/EIS, but is presented in this table as additional information.

Key:

PA = Preferred Alternative.

FEP = Full Economic Potential.

MMbbl = Million barrels.

Bcf/yr = Billion cubic feet per year.

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Table IV-08
Past Development: 2001 Production and Reserve Data

[illegible]	[illegible]	[illegible]	[illegible]	Began	Gas (Bcf)	2001 Oil (MMbbls)[1]	Production to	Oil (MMbbls)[2]	Gas (Bcf)
Duck Island									
	Endicott	O	1973	1987	—[4]	10.96	Endicott	177[3]	—[4]
	Sag Delta North[2]	O	1989	1989	—[4]	—[3]	Endicott	—	—[4]
	Sag Delta[2]	O	1976	1989	—[4]	—[3]	Endicott	—	—[4]
	Elder	O	1998	1998	—[4]	0.86	Endicott	4	—[4]
	Ivishak	O	—	—	—[4]	0.14	Endicott	—	—[4]
Prudhoe Bay									
	Prudhoe Bay	O	1967	1977	—[4]	194.24	Prudhoe	2,454	—[4]
	P Bay Satellites	O	—	—	—[4]	0	Prudhoe	144	—[4]
	Lisburne	O	1968	1981	—[4]	3.66	Lisburne	33	—[4]
	Niakuk	O	1985	1994	—[4]	7.02	Lisburne	49	—[4]
	West Beach	O	1976	1994	—[4]	0.12	Lisburne	5	—[4]
	N. Prudhoe Bay	O	1970	1993	—[4]	16.69	Lisburne	1	—[4]
	Pt. McIntyre	O	1968	1993	—[4]	1.74	Lisburne	208	—[4]
	Midnight Sun	O	1998	1999	—[4]	1.35	Prudhoe	11	—[4]
	Aurora	O	1999	2001	—[4]	0.42	Prudhoe	38[6]	—[4]
	Borealis	O	1999	2001	—[4]	1.31	Prudhoe	63[6]	—[4]
	Polaris	O	1999	2001	—[4]	0.07	Prudhoe	49[6]	—[4]
Kuparuk River									
	Kuparuk River	O	1969	1981	—[4]	68.27	Kuparuk	814	—[4]
	Tabasco	O	1992	1998	—[4]	1.32	Kuparuk	24	—[4]
	Tarn	O	1992	1998	—[4]	8.05	Kuparuk	46	—[4]
	West Sak	O	1969	1998	—[4]	2.0	Kuparuk	100	—[4]
	Meltwater	O	—	2001	—[4]	0.15	Kuparuk	52[6]	—[4]
	Palm	O	—	2002	—[4]	—	Kuparuk	35	—[4]

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Table IV-08
Past Development: 2001 Production and Reserve Data (continued)

[illegible]	[illegible]	[illegible]	[illegible]	Began	Gas (Bcf)	2001 Oil (MMbbl)[1]	Production to	Oil (MMbbl)[2]	Gas (Bcf)
Milne Point									
	Milne Point	O	1969	1985	—[4]	15.27	Milne Pt.	260[5]	—[4]
	Cascade[5]	O	1993	1996	—[4]	—	Milne Pt.	—[5]	—[4]
	Schrader Bluff	O	1969	1991	—[4]	3.82	Milne Pt.	99	—[4]
	Sag River	O	1968	1994	—[4]	0.25	Milne Pt.	7	—[4]
Badami									
	Badami	O&G	1990	1998	—[4]	0.67	TAPS	8	—[4]
Colville River									
	Alpine	O	1994	2000	—[4]	28.89	KuparuA	398	—[4]
	Nanuq	O	—	2001	—[4]	0.02	KuparuA	40	—[4]
Northstar									
	Northstar	O	1984	2001	—[4]	1.27	TAPS	175	—[4]
NPR-A[1]									
	East Barrow	G	1974	1981	0.086	—	Barrow	—	5
	South Barrow	G	1949	1950	0.042	—	Barrow	—	4
	Walakpa	G	1980	1993	1.348	—	Barrow	—	24
All Units or Areas Total				—	**1.476**	**370.16**	—	**6,204**	**33**

Notes:

[1] Production information is from State of Alaska, Oil and Gas Conservation Commission (2002). Includes oil and natural gas liquids.

[2] Reserves were estimated by subtracting 2000 and 2001 production (State of Alaska Oil and Gas Conservation Commission, 2001 and 2002) from the reserve data in State of Alaska, Dept. of Natural Recources (2000).

[3] Endicott includes Endicott, Sag Delta and Sag Delta North.

[4] Associated gas used as fuel for facilities or reinjected.

[5] Cascade is included in Milne Point.

[6] Reserve estimates for Aurora, Borealis, Meltwater, and Polaris are from *PI/Drilling Wire Plus*, 2001a, 2002, 2001b and 2001c, respectively.

Key:

— = Not applicable or not available.
MMbbl = Million barrels.
Bcf = Billion cubic feet.

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Table IV-09
Past Development: Infrastructure and Facilities

[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		G	C	U	Num.	Acres			Num.	Acres							
Duck Island																	
Endicott	392^{2}	3	26	—	1^{2}	179^{2}	129	2^{1}	0^{2}	0^{2}	0	0^{1}	3^{1}	2^{1}	0^{1}	15^{1}	1^{1}
Prudhoe Bay																	
Prudhoe Bay	4,590^{2}	—	—	145	6^{2}	726^{2}	1,764	38	106^{2}	560^{2}	6^{1}	4^{1}	4^{1}	2^{1}	2^{1}	200^{1}	3^{1}
Lisburne	213^{3}	50	—	—	0^{2}	0^{2}	80	5^{1}	10^{2}	18^{2}	1^{1}	1^{1}	1^{1}	0^{1}	0^{1}	18^{1}	—
Niakuk	22^{2}	5	—	—	0^{2}	0^{2}	19	—	0^{2}	0^{2}	—	—	—	—	—	—	—
West Beach	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
N. Prudhoe Bay	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Pt. McIntyre	33^{3}	12	—	—	0^{2}	0^{2}	84	-	0^{2}	0^{2}	—	—	—	—	—	—	—
Aurora	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Borealis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Polaris	—	—	—	—	—	—	—	1	0	0	0	0	0	0	0	—	0
Kuparuk River																	
Kuparuk River	1,435^{2}	97	37	—	5^{2}	564^{2}	996	34^{1}	126^{2}	161^{2}	3^{1}	2^{1}	4^{1}	1^{1}	1^{1}	94^{1}	5
West Sak	—	—	—	—	0	0	17	—	0	0	0	0	0	0	0	—	0
Palm	5	0	0	—	—	—	18	1	0	0	0	0	0	0	0	—	0
Meltwater	78	10	1	—	—	—	26	1	0	0	0	0	0	0	1	10	0

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Table IV-09
Past Development: Infrastructure and Facilities (continued)

[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	S	C	U	Num.	Acres	[illegible]	[illegible]	Num.	Acres							
[illegible]																	
Milne Point	205²	30	10	—	1²	43²	182	4¹	20²	19²	1¹	0¹	2¹	0¹	0¹	19¹	1¹
Cascade	31²	—	—	—	0²	0²	—	—	0²	0²	—	—	—	—	—	—	—
Schrader Bluff	—	—	—	—	—	—	52	—	—	—	—	—	—	—	—	—	—
Sag River	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—
[illegible]	[illegible]	—	—	—	1²	[illegible]	[illegible]	[illegible]	0²	0²	1	1	0	1	1	[illegible]	[illegible]
[illegible]	[illegible]	—	—	—	0	0	[illegible]	[illegible]	0	0	1	2	—	0	1	3	[illegible]
[illegible]																	
Tarn³	72.8	—	—	—	—	—	—	—	0	0	0	0	0	0	0	10	2
[illegible]	[illegible]	—	—	—	—	—	—	—	0	0	1	1	0	0	0	0	0
Totals	7,128	—	—	—	14	—	—	90	262	756	13	110	14	6	5	384	22
[illegible]																	
East Barrow	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—
South Barrow	—	—	—	—	—	—	19	—	—	—	—	—	—	—	—	—	—
Walakpa	—	—	—	—	—	—	9	—	—	—	—	—	—	—	—	—	—

Notes:

[1] Eg&G Idaho, Inc. (1991).

[2] BP Exploration (Alaska) Inc. (1996).

[3] U.S. Army Corps of Engineers, Public Notice of Application for Permit Reference Number 4-970705.

[4] Alaska Oil and Gas Conservation Commission 1998 Annual Report. Meltwater (*Petroleum New Bulletin*, 2000), Nanuq (*Petroleum News Bulletin*, 2001), and Palm wells estimated using a 2-MMbbl recovery typical of Kuparuk reservoir satellites.

— = Not available, unknown, or not applicable.

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Table IV-10
Present Fields: Estimated Reserve Data

Unit or Area	Field	Type (Oil or Gas)	Discovered	Status	Oil Reserves (MMbbl)
Colville River	CD North (Fiord)	Oil	1992	Present Development	50
Colville River	CD South (Nanuq)	Oil	1996	Present Development	38
Prudhoe	Orion (NW Eileen)	Oil	-	Present Development	50
Total for All Units or Areas					**138**

Key:
MMbbl = Million barrels.

Table IV-11
Present Fields: Proposed Infrastructure and Facilities for Development

[illegible]	[illegible]	[illegible]	Gravel Mines		Wells	Pads	Reserve Pits		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			Number	Acres			Number	Acres							
Colville River/CD North	40	7	1	45	40	1	0	0	0	0	0	0	1	0	0
Colville River/CD South	40	4	0	0	40	1	0	0	0	0	0	0	0	3.[illegible]	0
Prudhoe/Orion	-	5	0	0	60	1	0	0	0	0	0	0	0	-	0

Key:
- = Not available.

Source:
Nanuq (*Petroleum News Bulletin*, 2001)

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Table IV-12
Reasonably Foreseeable Future Development: Estimated Resources

Western Group	Spark/Rendezvous	Gas & Oil	2000	Onshore	
	Kalubik	Oil	1992	Offshore	
	Thetis Island	Oil	1993	Offshore	
Group Total					[illegible]
Central Group (Northstar)	Gwyder Bay	Oil	1969	Offshore	
	Pete's Wicked	Oil	1997	Onshore	
	Sandpiper	Gas & Oil	1986	Offshore	
	Liberty	Oil	1983	Offshore	
Group Total					320
Eastern Group (Badami)	Mikkelson	Oil	1978	Onshore	
	Sourdough	Oil	1994	Onshore	
	Liberty	Oil	1983	Offshore	
	Yukon Gold	Oil	1994	Onshore	
	Pt. Thompson	Gas & Oil	1977	Onshore	
	Flaxman Island	Oil	1975	Offshore	
	Stinson	Oil	1990	Offshore	
	Hammerhead	Oil	1985	Offshore	
	Kuvlum	Oil	1987	Offshore	
Group Total					1,000
Offshore Subtotal					1,070
Onshore Subtotal					300
Total					**1,570**

Notes:

1. Resource estimates are assumed for purposes of cumulative effects analysis only.

2. Accurate oil volumes for individual fields generally are unavailable as these discoveries have not been adequately delineated or studied for their development potential. Most of these discoveries are presently noncommercial and will require new technology or higher oil prices to be economic. It is possible that many of these pools will remain undeveloped. Future development likely would occur in conjunction with the infrastructure for the fields shown in parentheses.

3. Resource estimates for Hemi Springs and Ugnu are not included in the above table, but they are included in the 2.0 billion barrels expected to be produced from satellites, pools, and enhanced recovery in existing fields. Gas resources are not listed because commercial production from the North Slope will require a new gas transportation system to reach outside markets.

4. The oil volume, including the Point Thompson pool, is largely condensate recovered with associated gas production wells. It is assumed that produced gas will be used for field operations (fuel) or be reinjected into reservoirs in nearby oil fields to optimize oil production. Reinjected gas could be recovered at some later date when a transportation system for North Slope gas is constructed.

Key:

MMbbl = Million barrels.

Source:

USDOI, MMS, Alaska OCS Region.

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Table IV-13
Reasonably Foreseeable Future Development: Estimated New Infrastructure [1]

Western Group	4	120	131	1	1	1	0	0	38
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Eastern Group	10	316	343	6	4	2	3	12	131
[illegible]	1	[illegible]	[illegible]	0	0	0	0	12	12

Notes:

[1] Development assumptions:

- Industry will minimize permanent (gravel and sand) roads by using ice roads.
- New pipelines from satellite fields will tie into pipelines from main fields (Alpine, Northstar, Badami, and Kuparuk River).
- Number of pads and wells is estimated from resource volumes.
- Production pad footprints are estimated from number of pads, connecting roads, landfalls/docks, and airstrips.
- Hemi Springs and Ugnu are considered to be examples of satellite development and enhanced oil recovery, respectively, and will be developed using existing infrastructure of the Prudhoe Bay and Kuparuk River fields.

[2] For the list of the oil and gas pools in each group see Table IV-12.

Source:
USDOI, MMS, Alaska OCS Region.

Table IV-14
North Slope Oil and Gas Production (1969 to December 2001)

[illegible]	[illegible]	[illegible]	[illegible]
Onshore	13.256	40.24	[illegible]
[illegible]	[illegible]	[illegible]	
Total	13.625	40.24	

Note:
[1] Oil includes crude and natural gas liquids.

Key:
Bbbl = Billion barrels.
Bcf = Billion cubic feet.

Source:
USDOI, MMS, Alaska OCS Region.

Table IV-15
Summary of Reserve and Resource Estimates Used in the Cumulative Analysis

[illegible]	[illegible]	[illegible]	[illegible]
Low End of the Range (Past and Present)	5	7.4	Table IV-08, Table IV-10, Table IV-1
Middle Portion (Past, Present, and Reasonably Foreseeable)	11	8.6	Table IV-08, Table IV-10, Table IV-12, Table IV-1
High End (Past, Present, Reasonably Foreseeable, and Speculative)	15	2.4	Table IV-1

Source:
USDOI, MMS, Alaska OCS Region.

Key:

Bbbl = Billion barrels.

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Table IV-16
Production, Reserves, and Resource Estimates Used in the Cumulative Analysis [1]

Timeframe and Field or Area	Oil (Bbbl)	Gas (Bcf)
Past and Present (total)	**5.432**	**33 [3]**
Onshore–past (Prudhoe Bay, Kuparuk River, Milne Point, Badami, Colville River & NPR-A)	4.938	33 [2]
Offshore–past (Duck Island Unit and Northstar)	0.356	
Onshore–present (CD North, CD South, and Orion)	0.138	
Reasonably Foreseeable Future (total)	**5.62**	**— [3]**
Discovered Onshore	0.500	
Discovered Offshore	1.070	
Undiscovered Offshore (Beaufort Sea Sales 186, 195, and 202)	1.380 [6a]	
Undiscovered Onshore	2.300 [5]	
Undiscovered Onshore (NW NPR-A Multiple Sales)	0.370	
Speculative (total)	**3.59**	**32,800 [4]**
Onshore	2.67 [5]	
Offshore	0.92 [6b]	
Total	**14.642**	**32,834**

Notes:

[1] Production and reserve data are as of July 2002.

[2] Gas production to date is from Barrow gas fields supplied for local use to the Barrow community.

[3] All gas production from existing oilfields is used by facilities for fuel or reinjected for reservoir pressure maintenance. No gas production is transported and marketed outside the North Slope.

[4] Future production of natural gas assumes that a transportation system will eventually be constructed to move North Slope gas resources to outside markets. All proposed systems are uneconomic under current conditions.

[5] Includes 2.0 billion barrels in unnamed satellite fields and enhanced oil recovery from existing oil fields. Also includes 0.300 and 0.370 billion barrels estimated for NE and NW NPR-A multiple sales, respectively.

[6a] Includes 50% of the mid-point undiscovered resources between the base case ($18.00/bbl) and high case ($30.00/bbl) of the 2000 Beaufort Sea Assessment (MMS).

[6b] Includes the remaining 50% of the mid-point undiscovered offshore resources recoverable between $18.00 and $30.00 per barrel of 2000 Beaufort Sea Assessment (MMS).

Key:
Bbbl = Billion barrels.
Bcf = Billion cubic feet.

Source:
USDOI, MMS, Alaska OCS Region.

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Table IV-17
Oil Spill Scenario Assumptions for Alternative A, Alternative B, and the Preferred Alternative

Small Spills [1] (< 500 bbl) Onshore and Offshore				**Alt A**	**Alt B and Preferred Alt**	
IV. C IV. D IV. E V.	Operational Spills from All Sources	Diesel or Crude		130	112	Ice, Tundra, Snow, Gravel Pad, Water
		Refined	0.7	323	277	
Large Spills (≥ 500 bbl) Onshore or Offshore				**Alt A**	**Alt B and Preferred Alt**	
IV. C IV. D IV. E IV. F V.	Pipeline	Crude	50	1	1	Ice, Tundra, Snow, Gravel Pad, Water
	Platform/Gravel Pad	Crude	90			
	Storage Tank/Gravel Pad	Diesel	90			
Very Large Spills (≥ 120,000 bbl)				**Alt A**	**Alt B and Preferred Alt**	
IV. J	Platform Blowout	Crude	120,000	–	–	Ice, Tundra, Snow, Gravel Pad, Water

Notes:
[1] See Table App 9-07 for distribution of small crude spills from Alternative A, Alternative B, and the Preferred Alternative.
– Not applicable.

Key:

EIS = Environmental Impact Statement.
bbl = Barrels.
Alt = Alternative.
≥ = Greater Than or Equal To.
< = Less Than.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table IV - 18
Estimates for Speculative Oil and Gas Resources

Area	Oil (Bbbl)	Gas (Tcf)	Study/Source
Beaufort Shelf	1.8 – 3.2	—	USDOI, MMS (2000)- Update Assessment for 2002-2007 OCS Program.
Beaufort-MacKenzie River Delta	1.0	9.0	National Energy Board, Canada, *Probabilistic Estimates of Hydrocarbon Volumes in the MacKenzie Delta and Beaufort Sea Discoveries.*
NPR-A	0 – 5.6	—	USGS Fact Sheet 045-02, 2002.
Arctic National Wildlife Refuge	0 – 6.3	—	USGS ANWR Assessment Team, Open-file Report 98-34.
North Slope-State lands	4.0	—	Informal industry estimates of oil recoverable through enhanced recovery technology and from new, small satellite fields near existing North Slope infrastructure.
	—	32.8	Discovered but undeveloped gas reserves, mainly associated with existing oil fields (Sherwood and Craig, 2000).
Chukchi Shelf	1.0 – 6.1	—	USDOI, MMS (2000)- Update Assessment for 2002-2007 OCS Program.

Notes:

1. The resource estimates for the Beaufort Shelf (USDOI, MMS, 2000) and Northern Alaska (U.S. Geological Survey, 1995) are mean undiscovered volumes that are economically recoverable at oil prices between $18 and $30 per barrel. Economic resources represent a small fraction of the total recoverable petroleum endowment, much of which is in pools too small or too remote to be economic under the current modeling assumptions. It is impossible to accurately predict the timing of commercial discoveries or future production volumes for speculative resources. Resource estimates often change with new information or modeling assumptions. For example, a new Geological Survey assessment (1998) reports that more economic oil may occur in the small coastal plain of the Arctic National Wildlife Refuge than previously estimated (in the U.S. Geological Survey done in1995) for all of Northern Alaska.

2. For the cumulative case, regional exploration in Arctic Alaska is not complete and development may be delayed long into the future. The hope for giant oil fields will continue to draw leasing and exploration activities in the future. However, it is unreasonable to speculate on the timing and infrastructure needed to produce resources that have not been discovered. More than 30 trillion cubic feet of gas have been discovered on the North Slope and remain undeveloped because of the lack of a regional transportation infrastructure and market. This huge proven resource base will likely be produced before major exploration efforts are focused on undiscovered gas resources in other onshore areas or in the Beaufort Sea off Alaska.

Key:

Bbbl = Billion barrels.
Tcf = Trillion cubic feet.
— = Not available of not applicable.

Sources:

USDOI, MMS, 2000; U.S. Geological Survey, 1995, 1998; National Energy Board of Canada, 1998.

Table IV-19
Assumed Large (≥500 barrels) Crude Oil Spills for Life of the Northwest NPR-A

Alternative	[illegible]					
	First Spill			Multiple Spills		
	Estimated Number of Spills	Estimated Total Spill Volume (bbl)	Percent Chance of One or More Spills	Estimated Number of Spills	Estimated Total Spill Volume (bbl)	Percent Chance of One or More Spills
No Action	0	0	<0.5	0	0	<0.5
A	0	0	<0.5	0	0	<0.5
B	0	0	<0.5	0	0	<0.5
C	0	0	<0.5	0	0	<0.5
Preferred Alternative	0	0	<0.5	0	0	<0.5

Alternative	[illegible]					
	First Spill			Multiple Spills		
	Estimated Number of Spills	Estimated Total Spill Volume (bbl)	Percent Chance of One or More Spills	Estimated Number of Spills	Estimated Total Spill Volume (bbl)	Percent Chance of One or More Spills
No Action	0	0	<0.5	0	0	<0.5
A	1	500 or 900	38	1	500 or 900	38
B	1	500 or 900	33	1	500 or 900	33
C	0	0	<0.5	0	0	<0.5
Preferred Alternative	1	500 or 900	33	1	500 or 900	33

Note:
The estimated number of oil spills is based on the estimated volume of resources multiplied by the Alaska North Slope spill rate. See Appendix 9 for a detailed explanation.

Key:
bbl = Barrel(s).
≥ = Greater Than or Equal To.
< = Less Than.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table IV-20
Assumed Small (<500 barrels) Crude/Refined Oil Spills for Life of Northwest NPR-A

Alternative	Crude Oil at $18/bbl									
	First Sale					Multiple Sales				
	Estimated Number of Spills		Estimated Total Spill Volume (bbl)		Percent Chance of One or More Spills	Estimated Number of Spills		Estimated Total Spill Volume (bbl)		Percent Chance of One or More Spills
	Crude	Refined	Crude	Refined		Crude	Refined	Crude	Refined	
No Action	0	0	0	0	<0.5	0	0	0	0	<0.5
A	0	0	0	0	<0.5	0	0	0	0	<0.5
B	0	0	0	0	<0.5	0	0	0	0	<0.5
C	0	0	0	0	<0.5	0	0	0	0	<0.5
Preferred Alternative	0	0	0	0	<0.5	0	0	0	0	<0.5
Alternative	Crude Oil at $30/bbl									
	First Sale					Multiple Sales				
	Estimated Number of Spills		Estimated Total Spill Volume (bbl)		Percent Chance of One or More Spills	Estimated Number of Spills		Estimated Total Spill Volume (bbl)		Percent Chance of One or More Spills
	Crude	Refined	Crude	Refined		Crude	Refined	Crude	Refined	
No Action	0	0	0	0	0	0	0	0	0	0
A	130	323	393	226	> 99.9	130	323	393	226	> 99.9
B	112	277	336	194	> 99.9	112	277	336	194	> 99.9
C	0	0	0	0	0	0	0	0	0	0
Preferred Alternative	112	277	336	194	> 99.9	112	277	336	194	> 99.9

Notes:
The estimated number of oil spills is based on the estimated volume of resources multiplied by the Alaska North Slope spill rate. See Appendix 9 for a detailed explanation.

Key:

bbl = Barrel(s).

≥ = Greater Than or Equal To.

< = Less Than.

Source:

USDOI, MMS, Alaska OCS Region, 2002.

Table IV-21
Effects of Alternative A on Employment and Personal Income by Place of Residence with Oil at $18/bbl[1]

	Direct Workers	Indirect & Induced Workers	Total	Direct Workers	Indirect & Induced Workers	Total
North Slope Borough[2]						
Exploration Phase	2	1	3	0.2	0.1	0.3
Southcentral Alaska[3] and Fairbanks North Star Borough						
Exploration Phase	27	13	40	2.1	0.4	2.5

Notes:

[1] $18 per barrel of oil.
[2] Communities in the North Slope Borough, but not the worker enclaves.
[3] Southcentral Alaska includes the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough.

Source:
MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model."

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Table IV-22
Effects of Alternative A on Employment and Personal Income by Place of Residence with Oil at $30/bbl[1]

Phase of Activity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
North Slope Borough[2]						
Exploration Phase	4	1	5	0.4	0.1	0.5
Development Phase	60	20	80	4.8	2.0	6.8
Production Phase	9	3	12	0.6	0.3	0.9
Southcentral Alaska[3] and Fairbanks North Star Borough						
Exploration Phase	52	26	78	4.2	0.8	5.0
Development Phase	800	400	1,200	64.0	12.0	76.0
Production Phase	340	170	510	27.0	5.0	33.0

Notes:

[1] $30 per barrel.
[2] Communities in the North Slope Borough, but not worker enclaves.
[3] Southcentral Alaska includes the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough.

Source:
MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model."

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Table IV-23
Impacts of Oil Spills on Types of Vegetation

Water	
Ice	0.0
Clear Water	0.0
Turbid Water	0.0
Aquatic	
Carex aquatilis	2.4
Arctophila fulva	0.7
Flooded Tundra	
Low Centered Polygons	7.1
Nonpatterned	4.8
Wet Tundra	7.7
Moist Tundra	
Sedge/Grass Meadow	7.9
Tussock Tundra	28.2
Moss/Lichen	2.0
Shrub	
Dwarf	32.4
Low	4.9
Tall	0.0
Barren Ground	
Sparsely Vegetated	0.4
Dunes/Dry Sand	0.5
Other	0.8

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Table IV-24
Pipelines — Trans-Alaska Pipeline System and Future Natural Gas Pipeline Projects

[illegible]	[illegible]	[illegible]
Active Pipeline Project		
Trans-Alaska Pipeline System (TAPS)	800	**Characteristics** Key transportation link for all North Slope oil fields. Since start-up in 1977 TAPS has carried nearly 13 billion barrels of oil. The pipeline corridor that runs between Prudhoe Bay and Valdez contains approximately 16.3 square miles. The Dalton Highway (Haul Road) was constructed parallel to the pipeline between Prudhoe Bay and Livengood. In 1988, TAPS throughput came close to its design capacity of 2 million barrels per day. Present throughput is approximately 1.0 million barrels per day. TAPS' lower operational limit is estimated at between 200,000 and 400,000 barrels per day. **Regulatory Requirements** TAPS 30-year Lease Renewal Environmental Impact Statement out for public comment as of October, 2002. **Current Status** If oil production from northern Alaska cannot be sustained above minimum throughput, TAPS will not be able to operate, shutting in all North Slope oil production.
Future Natural Gas Pipeline Projects		
Trans-Alaska Gas System (TAGS)	800	**Characteristics** The TAGS plan consists of: 1. a LNG-grade pipeline substantially parallel to TAPS from Prudhoe Bay to Valdez, 2. a LNG plant at Anderson Bay near Valdez, and 3. a fleet of new LNG carriers. LNG would be transported to Japan and other Pacific Rim countries. Project design recently scaled back to a 30-inch pipeline able to transport 7 million tons annually. **Regulatory Requirements** BLM completed an EIS and granted a federal right-of-way in 1988. A Presidential finding and an export license are in place. A separate EIS, conducted by FERC, covers the Anderson Bay terminal. A conditional State of Alaska right-of-way lease was renewed in 1999 for 10 years. **Current Status** Stalled because of no commitment from the North Slope gas producers, lack of delivery contracts to Asian buyers, and high construction costs.

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Table IV-24
Pipelines — Trans-Alaska Pipeline System and Future Natural Gas Pipeline Projects (continued)

		Future Natural Gas Pipeline Projects (continued)
Alaska Natural Gas Transportation System (ANGTS)[1]	2,102	**Characteristics** Connects Alaska North Slope gas production through Canada to markets primarily in the U.S. via a high-pressure pipeline. Parallels TAPS as far as Delta Junction in interior Alaska and then crosses Yukon Territory to connect to existing pipelines in Alberta and the Lower 48. **Regulatory Requirements** BLM completed an EIS and issued a federal grant of right-of-way in 1980. An existing 1978 treaty between the United States and Canada sanctions the proposal. Associated Canadian permits and approvals are in place. The Alaska Natural Gas Transportation Act (ANGTA) of 1976 — in concert with the Presidential Decision of 1977 — provided for the construction of a gas pipeline along the Alaska Highway route. The project has a conditional Federal Energy Regulatory Commission (FERC) certificate. **Current Status** Project proponents have twice begun (but subsequently suspended) the process to secure a State of Alaska right-of-way lease. Downward revisions to construction costs and the recent increase in gas prices into the $3-4 per million cubic foot range make this project more appealing today. Variations to routes are currently being considered.
Arctic Resources, Northern Gas Pipeline Project	326 offshore 874 onshore	**Characteristics** 52-inch, high-pressure gas pipeline would run offshore from Prudhoe Bay in Alaska to the Mackenzie delta in Northwest Territory and then south through the Mackenzie River Valley to the existing gas pipeline network in northern Alberta. The 326- mile offshore portion would be trenched in 30-60 feet of water. The 874-mile onshore portion also would be buried. Designed to deliver 2.5 billion cubic feet per day to markets primarily in the United States. **Regulatory Requirements** FERC approval, an EIS, a federal right-of-way and a State Lease would be required for this project. **Current Status** Commitments of gas producers and gas buyers have not yet been obtained, nor have the regulatory requirements been met. Requires a consortium of gas producers, pipeline companies, and Native corporations in both Alaska and Canada.

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Table IV-24
Pipelines —Trans-Alaska Pipeline System and Future Natural Gas Pipeline Projects (continued)

Future Natural Gas Pipeline Projects (continued)		
Natural Gas to Liquids Conversion[2]	Will use existing TAPS Pipeline	**Characteristics** GTL is an attractive option because it will use the existing TAPS pipeline (extending its life and lowering future tariffs) and produce clean-burning fuels to meet more stringent Environmental Protection Agency emission standards for vehicles. At present, the overall cost of a full-scale gas to liquids project is comparable to a similar sized LNG project. As an emerging technology, new cost-reduction breakthroughs are expected for gas to liquids processing, improving the economic potential for future gas to liquid projects. **Regulatory Requirements** Monitoring emission levels of CO_2 and NOx. Waste waters are discarded to a leach field monitored by well sampling. Distillation by-products ([illegible]ults) are transported and treated in Anchorage by Emerald Services. **Current Status** All of the major North Slope gas owners (BP-Amoco, Exxon-Mobil, and Phillips-Alaska) are studying the feasibility of various gas commercialization projects. British Petroleum is presently constructing a $70 million prototype GTL plant at Nikiski, Alaska. The plant is scheduled to be operational in 2002. ExxonMobile has also advocated the GTL concept.

Notes:
[1] Thomas et al., 1996.
[2] *Alaska Report*, 1997.

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Table IV-25
Future Lease Sales

[illegible]	[illegible]	[illegible]	[illegible]
Federal			
[illegible]	[illegible]	As much as 9.8 million acres in the Beaufort Sea from the Canadian border on the east to Barrow on the west (Federal Register, 2001c).	[illegible] Bbbl Oil (Estimated)
Northeast NPR-A	Approximately every two years		
Northwest NPR-A	To Be Determined	As much as [illegible] million acres of the Northwest NPR-A Planning Area (Federal Register, 2001c).	[illegible] Bbbl Oil (Estimated)
State of Alaska			
North Slope Areawide	Oct 2002 Oct 2003 Oct 2004 Oct 2005 Oct 2006	As much as [illegible] acres of State-owned lands between the Canning and Colville Rivers and south of the Umiat Base Line (about [illegible] N.).	Moderate to High
Beaufort Sea Areawide	Oct 2002 Oct 2003 Oct 2004 Oct 2005 Oct 2006	Unleased State-owned tide and submerged lands between the Canadian border and Point Barrow and some coastal upland acreage along the Beaufort Sea between the Staines and Colville rivers. The gross proposed sale area exceeds 2,000,000 acres. The State of Alaska was scheduled to hold its first areawide sale in the Beaufort Sea on October 13, 1999. This sale was delayed pending the outcome of the British Petroleum-Amoco and ARCO-Phillips mergers and related uncertainties in future lease holdings.	Moderate to High
North Slope Foothills Areawide	May [illegible] May 2004 May 2005 May 2006	State-owned lands lying between the NPR-A and the Arctic National Wildlife Refuge south of the Umiat Baseline and north of the Gates of the Arctic National Park and Preserve. The gross proposed sale area exceeds [illegible] acres.	Moderate

Key:
Bbbl = Billion barrels.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table IV-26
Discharge Conditions for a Well Blowout

Discharge Category	[illegible]				
	Day 1	Day 2	Day 3	[illegible]	[illegible]
Well's Discharge Volume	8,000	8,000	8,000	8,000	120,000
Evaporation (30%)[1]	-2,400 [3]	-2,400 [3]	-2,400 [3]	-2,400 [3]	-36,000 [3]
Fall out to Gravel Island	2,800	2,800	2,800	2,800	84,000
Oil Remaining on Gravel Pad	-2,800 [3]	-600 [2, 3]	0 [2]	0 [2]	-3,400 [3]
Oil Draining to Ground from Gravel Pad	0	2,200	2,800	2,800	38,600
Oil Falling to Ground	2,800	2,800	2,800	2,800	42,000
Total Oil to the Ground	**2,800**	**5,000**	**5,600**	**5,600**	**80,600**

Notes:

[1] Evaporation was calculated using a 330-barrel per hour rate and Alpine crude oil characteristics in the Sintef Oil Weathering Model (Reed et al., 2001).

[2] After hour 26, the gravel pad is saturated with oil and all subsequent oil falling on the gravel pad drains to the ground. The gravel pad is assumed to be a 5-acre area.

[3] Negative numbers represent volume that was not included in the model because the amounts do not drain to the ground where they may affect sensitive environmental resources.

Source:
Compilation of several oil discharge prevention and contingency plans on the North Slope.

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Table IV-27
Results of Colville Delta Exploration Wells

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colville State #1	Sinclair	T12N R7E 25	03/08/66	Oil Show	30	—
[illegible]	[illegible]	[illegible]	[illegible]	—	0	—
Colville Delta State #1	Gulf	T13N R6E 9	04/22/70	—	0	—
[illegible] #1	[illegible]	[illegible] 18	[illegible]	Oil Show	30	--
Colville Delta #1	ARCO	T13N R7E 17	04/07/85	1,070	110	25
Colville Delta #1A	ARCO	T13N R7E 17	[illegible]	[illegible] Mcf gas/day	110	—
Colville Delta #2	ARCO	T13N R7E 23	03/16/86	500	90	28
Colville Delta #3	ARCO	T13N R7E 33	[illegible]	681	70	33
Colville Delta #25-1	ARCO	T13N R6E 25	03/03/86	159	90	25
Fiord #1	ARCO	T12N R5E 2	[illegible]	1,[illegible]	90	32
Kalubik #1	ARCO	T13N R7E 11	05/01/92	1,200	120	28
Fiord #2	ARCO	T12N R5E 24	[illegible]	Well data not released		
Till #1	ARCO	T12N R5E 32	03/18/93	—	0	—
[illegible]	ARCO	T13N R5E 22	[illegible]	100	60	27
Colville River #1	ARCO	T11N R6E 17	04/17/93	—	0	—
Bergschrund #1	ARCO	T12N R5E 32	04/14/94	Well data not released		
Alpine #1B*	ARCO	T11N R4E 1	03/23/96	Well data not released		
Alpine #1*	ARCO	T12N R4E 25	03/11/96	Well data not released		
Alpine State #1	ARCO	T11N R4E 1	02/16/95	Well data not released		
Alpine State #1A	ARCO	T11N R4E 1	03/01/95	Well data not released		
Bergschrund #2	ARCO	T11N R5E 9	02/27/96	Well data not released		
Bergschrund #2A	ARCO	T11N R5E 9	04/17/96	Well data not released		
Fiord #3	ARCO	T12N R5E 25	04/04/95	Well data not released		
Fiord #3A	ARCO	T12N R5E 25	04/15/95	Well data not released		
Nanuk #1	ARCO	T11N R5E 19	03/24/96	Well data not released		
[illegible] #1	ARCO	T11N R4E 14	04/23/96	Well data not released		
Temptation #1	ARCO	T12N R4E 16	04/04/96	Well data not released		
Temptation #1A	ARCO	T12N R4E 16	04/23/96	Well data not released		
Alpine #2	ARCO	T11N R5E 9	---- PROPOSED WELL ----			
[illegible] #1A	ARCO	T11N R4E 14	---- PROPOSED WELL ----			
Neve #1B	ARCO	T11N R4E 14	---- PROPOSED WELL ----			
[illegible] #1	ARCO	T11N R4E [illegible]	---- PROPOSED WELL ----			

Notes:
[1] Unless otherwise noted.

Key:
BPD = barrels per day.
Mcf = thousand cubic feet.
— = Not available, unknown, or not applicable.

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Table IV-28
Summary of Selected Non-Oil and Gas-Related Management Activities [1]

	No Action	A	B	C
Aircraft Use [2]				
Point-to-Point	regular but not daily	occasional	regular but not daily	regular but not daily
Wildlife Aerial Surveys	**14 days during June and July**	**21 days during June and July**	**21 days during June and July**	**21 days during June and July**
Other Aurial Surveys	occasional	several 2- to 3-week periods	several 1- to 2-week periods	several 1- to 2-week periods
Excavation and Collection				
Research/Archeological	1 acre disturbed	6 acres disturbed	4 acres disturbed	2 acres disturbed
Ground Activities [3]				
Large Camps [4]	6 weeks	12 weeks	12 weeks	12 weeks
Small Camps	**3 weeks**	**6–12 weeks**	**6–12 weeks**	**6–12 weeks**
Overland Moves	20–60 trips	20–60 trips	20–60 trips	20–0 trips
Recreation (Colville River float trip parties)[5]	5 with SRP's [6] 3 casual parties	5 with SRP's 3 casual parties	5 with SRP's 3 casual parties	5 with SRP's 3 casual parties

Notes:

[1] All estimates are for levels of annual activity.

[2] This does not include use that is associated directly with oil and gas development or recreation; assumes that fixed-wing aircraft and helicopters are used; assumes that use occurs almost exclusively in summer.

[3] Camps in this category are not associated directly with oil and gas development or recreation; assumes that all camps occur in summer.

[4] Large camps are at least 15 persons and may have 5,000 gallons of fuel. Camps are likely to be located at Umiat, Lonely, Ivotuk, Inigok, and sites near the headwaters of the Kiligwa and Meade Rivers.

[5] Average of 4 persons per party.

[6] Special Recreation Permits, i.e. guided, regulated by BLM.

Table IV-29
Pipeline Scenarios for Alternative A, Alternative B, and Preferred Alternative

	[illegible]		[illegible]		[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] Side - Alternative A							
State Lands	–	35	–	–	–	70	35
NE NPR-A	–	100	–	–	–	100	100
NW NPR-A	70	25	–	–	70	25	95
Total	**70**	**160**	–	–	**70**	**195**	**230**
[illegible] Side - Alternative A							
State Lands	–	120	–	0	0	70	120
NE NPR-A	—	125	–	100	–	100	225
NW NPR-A	170	125	–	100	170	25	395
Total	**170**	**370**	–	**200**	**170**	**195**	**740**
[illegible] Side - Alternative B and Preferred Alternative							
State Lands	–	35	–	–	–	70	35
NE NPR-A	–	100	–	–	–	100	100
NW NPR-A	45	25	–	–	45	25	70
Total	**45**	**160**	–	–	**45**	**195**	**205**
[illegible] Side - Alternative B and Preferred Alternative							
State Lands	–	120	–	–	–	70	120
NE NPR-A	–	125	–	100	–	100	225
NW NPR-A	115	125	–	100	115	25	340
Total	**115**	**370**	–	**200**	**115**	**195**	**685**

Notes:
– = Not applicable.

Pipeline mileage does not include in-field flowlines, only gathering lines to central facilities and overland main lines to the existing pipeline network on State lands. Pipeline mileage is for right-of-way corridors that could hold both oil- and gas-sales lines and service lines (product/fuel, seawater, communication).

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Table IV-30
Effects of Preferred Alternative on Employment and Personal Income by Place of Residence with Oil at $18/bbl[1]

	[illegible]	[illegible]	Total	[illegible]	[illegible]	Total
North Slope Borough[2]						
Exploration Phase	2	1	3	0.2	0.1	0.3
Southcentral Alaska[3] and Fairbanks North Star Borough						
Exploration Phase	24	12	36	1.9	0.4	2.3

Source:
MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model."

Notes:
[1] $18 per barrel.
[2] Communities in the North Slope Borough, but not the worker enclaves.
[3] Southcentral Alaska includes the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough.

Table IV-31

Effects of Preferred Alternative on Employment and Personal Income by Place of Residence with Oil at $30/bbl[1]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]						
Exploration Phase	4	1	5	0.4	0.1	0.5
Development Phase	54	18	72	4.3	1.8	6.1
Production Phase	8	3	11	0.5	0.3	0.8
Southcentral Alaska[3] and Fairbanks North Star Borough						
Exploration Phase	47	23	70	3.8	0.7	4.5
Development Phase	720	360	1,080	58.0	11.0	69.0
Production Phase	306	154	460	24.3	4.5	28.8

Source:
MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model."

Notes:

[1] $30 per barrel.

[2] Communities in the North Slope Borough, but not worker enclaves.

[3] Southcentral Alaska includes the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough.

Table V-01
Protective Allocations for Rivers Eligible but not Suitable for Designation as Components of the National Wild and Scenic Rivers System.

Alatakruk	Deferral Area/Native Land Management
Alaktak	Coastal Area/No Facilities within Buffer Area.
Avak	Deferral Area
Avalik	No Facilities within Buffer Area.
Chipp	Coastal Area/No Facilities within Buffer Area.
Inaru	No Facilities within Buffer Area.
Ivisaruk	Deferral Area
Kaolak	Deferral Area
Ketik	Deferral Area
Kigalik	No Facilities within Buffer Area.
Kuk	Deferral Area
Kungok	Deferral Area
Meade	Coastal Area/No Facilities within Buffer Area.
Nokotlek	Deferral Area/Kasegaluk Lagoon Special Area
Ongoravik	Deferral Area/Kasegaluk Lagoon Special Area
Oumalik	No Facilities within Buffer Area.
Titaluk	No Facilities within Buffer Area.
Topagoruk	No Facilities within Buffer Area.
Tunalik	Deferral Area/Kasegaluk Lagoon Special Area
Usuktuk	No Permanent or Temporary Facilities within Buffer Area.
Maybe Creek	No Permanent or Temporary Facilities within Buffer Area.

Table App 7-01
Undiscovered, Risked, Conventionally Recoverable Oil and Gas Resources for Northwest and Northeast NPR-A Planning Areas (2002)

[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
			F95	Mean	F05	F95	Mean	F05	Rank 1	Rank 2	Rank 3	Rank 1	Rank 2	Rank 3
1	Endicott-Barrow Arch	UBWA0100	157	334	600	0.302	0.573	0.916	103	62	42	196	120	81
2	Endicott-Arctic Platform	UBWA0200	2	9	18	0.032	0.122	0.238	2	2	2	94	27	22
3	Ellesmerian-Gas Belt	UBWA0300	-	30^2	78^2	-	1.209	3.017	Gas	Gas	Gas	263	156	135
4	Lisburne-Barrow Arch	UBWA0400	59	161	341	0.165	0.373	[illegible]	59	31	19	140	78	49
5	Lisburne-Arctic Platform	UBWA0500	-	1	4	-	0.017	0.076	2	1	1	28	16	11
6	Sadlerochit/Sag River-Barrow Arch-East	UBWA0600	480	949	1778	0.919	1.708	3.094	310	167	106	605	327	210
7	Sadlerochit-Arctic Platform-East	UBWA0700	-	56	152	-	0.489	1.376	28	20	14	315	130	117
8	Beaufortian-Barrow Arch-East	UBWA0800	3574	4755	6359	6.898	10.425	17.283	634	441	385	2881	884	713
9	Beaufortian- Arctic Platform-East	UBWA0900	-	192	382	-	2.107	4.871	41	27	24	988	293	224
10	Beaufortian-Gas Belt	UBWA1000	1^2	7^2	18^2	0.043	0.304	0.814	Gas	Gas	Gas	143	53	34
11	Brookian Turbidites-Arctic Platform-East	UBWA1100	378	609	897	1.706	3.157	5.559	75	73	30	729	342	219
12	Brookian-Gas Belt	UBWA1200	-	8^2	34^2	-	0.322	1.346	Gas	Gas	Gas	174	115	100
13	Brookian Topset-Arctic Platform-East	UBWA1300	59	139	244	0.346	0.815	1.668	28	25	9	307	132	71
14	Brookian Foldbelt	UBWA1400	354	830	1633	2.347	5.484	10.970	242	179	70	1186	824	845
15	Sag River/Shublik-Barrow Arch-West	UBWA1500	-	9	35	-	0.087	0.298	10	7	5	98	26	22
16	Sadlerochit-Arctic Platform-West	UBWA1600	-	5	23	-	0.087	0.394	9	8	None	150	105	90
17	Beaufortian-Barrow Arch-West	UBWA1700	13	57	128	0.123	0.509	1.397	19	9	4	263	90	41
18	Beaufortian-Arctic Platform-West	UBWA1800	17	64	163	0.287	1.188	3.040	5	2	2	521	193	127

			F95	Mean	F05	F95	Mean	F05	Rank 1	Rank 2	Rank 3	Rank 1	Rank 2	Rank 3
19	Brookian Turbidite-Arctic Platform-West	UBWA1900	-	34	95	-	0.300	0.710	6	3	2	86	44	35
20	Brookian Topset-Arctic Platform-West	UBWA20000	-	33	81	-	0.412	1.067	11	4	3	205	78	52
21	Endicott/Lisburne Thrust Belt	UBWA2100	Not in Northwest or Northeast NPR-A Planning Area											
22	Beaufortian-Deep Detached Foldbelt	UBWA2200	-	30	86	-	0.422	1.067	9	7	5	145	87	70
23	Fortress Mountain Formation-Deep Detached Foldbelt	UBWA2300	301	789	1386	3.103	7.109	11.733	180	142	115	1791	861	683
FASPAG Aggregation-All Plays			6,817	9,101	11,817	23.002	37.309	56.213	-	-	-	-	-	-

Notes:
[1] Includes natural gas liquids.
[2] 100% natural gas liquids.

Key:

Bcfg	= Billion cubic feet of gas.
MMbo	= Million barrels of oil.

Tcfg= Trillion cubic feet of gas.
F95 = 95% chance for exceeding indicated volume.
F05 = 5% chance for exceeding indicated volume.

Source:
USDOI, MMS and BLM.

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Table App 7-02
Economic Oil and Gas Resources in NPR-A:
Undiscovered, Risked, Economically Recoverable Resources

[illegible]	[illegible]	[illegible]				[illegible]	[illegible]			
		$18 Oil Price	$30 Oil Price	$2.98 Gas Price	$4.27 Gas Price	[illegible]	$18 Oil Price	$30 Oil Price	$2.98 Gas Price	$4.27 Gas Price
1	Endicott-BA	0.004	0.256	0.004	0.433	0.19	0.001	0.049	0.001	0.082
2	Endicott-AP	—	—	—	—	1.00	—	—	—	—
3	Ellesmerian gas	—	—	—	0.005	0.71	—	—	—	0.004
4	Lisburne-BA	—	0.047	0.001	0.081	0.00	—	—	—	—
5	Lisburne-AP	—	—	—	—	1.00	—	—	—	—
6	Sadlerochit-BA-east	0.017	0.286	0.019	0.495	0.46	0.008	0.132	0.009	0.228
7	Sadlerochit-AP-east	—	—	—	—	1.00	—	—	—	—
8	Beaufortian-BA-east	0.113	4.184	0.188	8.689	0.30	0.034	1.255	0.056	2.607
9	Beaufortian-AP-east	—	0.016	—	0.257	0.46	—	0.007	—	0.118
10	Beaufortian gas	—	—	—	—	1.00	—	—	—	—
11	Brookian-turbidites-east	—	0.158	—	0.755	0.35	—	0.055	—	0.264
12	Brookian gas	—	—	—	—	1.00	—	—	—	—
13	Brookian topset-east	—	0.014	—	0.073	0.36	—	0.005	—	0.026
14	Brookian foldbelt	—	0.539	—	3.350	0.80	—	0.431	—	2.680
15	Sag R/Shublik-west	—	—	—	—	0.10	—	—	—	—
16	Sadlerochit-AP-west	—	—	—	—	1.00	—	—	—	—
17	Beaufortian-BA-west	—	0.002	—	0.040	0.70	—	0.001	—	0.028
18	Beaufortian-AP-west	—	—	—	—	1.00	—	—	—	—
19	Brookian turbidites-west	—	—	—	—	0.90	—	—	—	—
20	Brookian topset-west	—	—	—	—	0.90	—	—	—	—
21	Endicott/Lis thrust belt	—	—	—	—	0.00	—	—	—	—
22	Beaufort detached fold	—	—	—	—	1.00	—	—	—	—
23	Fortress Mountain	—	0.195	—	1.652	0.77	—	0.150	—	1.272
Total		**0.134**	**5.697**	**0.212**	**15.830**	—	**0.043**	**2.086**	**0.066**	**7.309**
Percent of total		—	—	—	—	—	31%	37%	31%	46%

Key:

Bbbl	= Billion barrels.
NE	= Northeast.
NW	= Northwest.
NPR-A	= National Petroleum Reserve-Alaska.
Tcf	= Trillion cubic feet.

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Table App 9-01
North Slope Facility and Pipeline Crude Oil Spills > 500 Barrels (1985-2000)

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
07/28/89	Production Processing	Conoco, Inc.	Crude Oil	Milne Point Unit, CPF	Facility Tank Leak-overfill	825	925
08/25/89	Pipeline	ARCO Alaska, Inc.	Crude Oil	Kuparuk River Unit, Drill Site 2-U	Pipeline Leak-corrosion of block valve	340	510
12/10/90	Production Well Site	ARCO Alaska, Inc.	Crude Oil	Lisburne Unit, Drill Site L-5	Facility Explosion	—	600
08/17/93	Production Processing	ARCO Alaska, Inc.	Crude Oil/ Produced Water	Kuparuk River Unit, CPF 1	Facility Tank Leak-Corrosion	—	675
09/26/93	Production Processing	BP Exploration (Alaska)	Crude Oil	Prudhoe Bay Unit, Gathering Center 2	Facility Tank Leak-overflow from pump failure	—	650
08/21/00	Production Processing	BP Exploration (Alaska)	Crude Oil/ Produced Water	Prudhoe Bay Unit, Gathering Center 2	Facility Tank Leak-overflow from control system failure	700	715

Key:

bbl = Barrels.

CPF = Central Processing Facility.

— = Information unavailable.

Source:

Hart Crowser, Inc., 2000; BP Exploration (Alaska), Inc., 2001; State of Alaska, Dept. of Environmental Conservation, 2001.

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Table App 9-02
Trans-Alaska Pipeline Spills ≥ 500 Barrels Based on Reported High Quantity from June 1977 to December 2001

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
APSC ADEC UNK JPO	08/08/77	Pipeline Pump Station	APSC	Pump Station 8	Crude	TAPS Pump Station 8 (TAPS MP 489.2)	Facility Explosion ^{1,2,3} Unspecified^{5}	300 ^{1,2,3,5}	4,762 ^{2}
APSC ADEC UNK JPO	08/19/77	Pipeline	APSC	Check Valve 7	Crude	TAPS MP 26 (Check Valve 7)	Pipeline Leak – equipment damage ^{1,2,3} Human Error^{5}	1,000 ^{1,2,3,5}	1,800 ^{1} 2,620 ^{2}
APSC UNK JPO	12/15/78	Pipeline	APSC	Steele Creek	Crude	TAPS MP 457	Pipeline Leak – intentional sabotage ^{1,3} Unspecified^{5}	11,905 ^{1,3,5}	16,000 ^{1}
APSC ADEC UNK JPO	06/10/79	Pipeline	APSC	Atigun Pass	Crude	TAPS MP 166 (N. side of Atigun Pass)	Pipeline Leak – line break ^{1,2,3,5}	1,500 ^{1,3,5}	7,143 ^{2} 5,267 ^{5}
APSC ADEC UNK JPO	06/15/79	Pipeline	APSC	Little Tonsina	Crude	TAPS MP 734	Pipeline Leak – line break ^{1,2,3,5}	300 ^{2,3,5}	4,000 ^{1,2}
APSC ADEC UNK BLM JPO OSIR	01/01/81	Pipeline	APSC	Check Valve 23	Crude	TAPS MP 114.6 (Check Valve 23)	Pipeline Leak – leaking valve	1,000 ^{2}	1,500 ^{1,3,4,5} 2,000 ^{6} 2,381 ^{2}
APSC ADEC	04/20/96	Pipeline	APSC	Check Valve 92	Crude	TAPS MP 539.7 (Check Valve 92)	Pipeline Leak – loose fitting	800 ^{1,2}	811 ^{1}
APSC ADEC	10/04/01	Pipeline	APSC	TAPS MP 400	Crude	TAPS MP 400	Pipeline Leak- Intentional Sabotage – bullet hole	6,800 ^{1,2}	6,800 ^{1,2}

Key:
[1] APSC = Alyeska Pipeline Service Company.
[2] ADEC = Alaska Department of Environmental Conservation.
[3] UNK = Unknown.
[4] BLM = Bureau of Land Management.
[5] JPO = Joint Pipeline Office.
[6] OSIR = Oil Spill Intelligence Report.
bbl = Barrel.

Source:
Hart Crowser, Inc., 2000.

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Table App 9-03
TAPS Tanker Spills ≥ 1,000 bbl (1977 through 1999)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
08/29/78	*Overseas Joyce*	Balboa Channel	Perth Amboy, New Jersey	1,816
06/07/80	*Texaco Connecticut*	Panama Canal Zone	Port Neches, Texas	4,047
12/12/81	*Stuyvesant*	Gulf of Tehuantepec	Panama	3,600
12/21/85	*ARCO Anchorage*	Puget Sound	Cherry Point, Washington	5,690
01/09/87	*Stuyvesant*	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	15,000
07/02/87	*Glacier Bay*	Cook Inlet, Alaska	Nikiski, Alaska	4,900
10/04/87	*Stuyvesant*	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	14,286
01/03/89	*Thompson Pass*	Port of Valdez	Panama	1,700
03/24/89	*Exxon Valdez*	Prince William Sound, Alaska	Long Beach, California	240,500
02/07/90	*American Trader*	Huntington Beach, California	Long Beach, California	9,929
02/22/91	*Exxon San Francisco*	Fidalgo Bay, Washington	Anacortes, Washington	5,000

Key:
bbl =Barrel(s).

Sources:
Anderson and Lear, 1994; Anderson, 2000; Anderson and LaBelle, 2000.

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Table App 9-04
Alaska North Slope Historic Large and Small Crude Oil Spills: Estimated Spill Rates

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Small Crude-Oil Spills: <500 bbl. (1989-2000)	135,127 gal[1] (3,217 bbl)	1,178 [1]	2.7	6.6 [2]	178
Large Crude-Oil Spills: ≥500 bbl (1985-2000)	171,150 gal[1] (4,075 bbl)	6 [1]	680	9.36 [2]	0.64

Notes:

[1] Oil-spill databases are from the State of Alaska, Department of Environmental Conservation in Anchorage, Juneau, and Fairbanks; BP Exploration (Alaska) Inc.; and ARCO.

[2] North Slope production data is derived from the Trans-Alaska Pipeline System throughput data from Alyeska Pipeline Services Company.

Key:

bbl = Barrel(s).
Bbbl = Billion barrels.
gal = Gallon.
< = Less Than.
≥ = Greater Than or Equal To.

Source:

USDOI, MMS, Alaska OCS Region, 2002.

Table App 9-05
Large Crude Oil Spills Estimated Over the Production Life of the Northwest NPR-A

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
No Action	0.0	0.64	500 or 900	0	0
A	0.0	0.64	500 or 900	0	0
B	0.0	0.64	500 or 900	0	0
C	0.0	0.64	500 or 900	0	0
Preferred Alternative	0.0	0.64	500 or 900	0	0
Multiple Sales					
No Action	0.0	0.64	500 or 900	0	0
A	0.0	0.64	500 or 900	0	0
B	0.0	0.64	500 or 900	0	0
C	0.0	0.64	500 or 900	0	0
Preferred Alternative	0.0	0.64	500 or 900	0	0
[illegible]					
Alternative	Resources (Bbbl)¹	Spill Rate (Spills/Bbbl)	Assumed Spill Size (bbl)	Estimated Mean Number of Spills	Estimated Total Spill Volume (bbl)
First Sale					
No Action	0.0	0.64	500 or 900	0	0
A	0.735	0.64	500 or 900	0.47	500 or 900
B	0.630	0.64	500 or 900	0.40	500 or 900
C	0.0	0.64	500 or 900	0	0
Preferred Alternative	0.630	0.64	500 or 900	0.40	500 or 900
Multiple Sales					
No Action	0.0	0.64	500 or 900	0	0
A	0.735	0.64	500 or 900	0.47	500 or 900
B	0.630	0.64	500 or 900	0.40	500 or 900
C	0.0	0.64	500 or 900	0.0	0
Preferred Alternative	0.630	0.64	500 or 900	0.40	500 or 900

Note:

[1] The estimated mean number of oil spills is based on the estimated resource volumes multiplied by the spill rate.

Key:

bbl = Barrel(s).
Bbbl = Billion barrels.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-06
Small Crude Oil Spills Estimated Over the Production Life of the Northwest NPR-A

[illegible]	[illegible]	Spill Rate (Spills/Bbbl)	Assumed Spill Size (bbl)	Estimated Mean Number of Spills	Estimated Total Spill Volume (bbl)
[illegible]					
No Action	0.0	178	3	0	0
A	0.0	178	3	0	0
B	0.0	178	3	0	0
C	0.0	178	3	0	0
Preferred Alternative	0.0	178	3	0	0
Multiple Sales					
No Action	0.0	178	3	0	0
A	0.0	178	3	0	0
B	0.0	178	3	0	0
C	0.0	178	3	0	0
Preferred Alternative	0.0	178	3	0	0

Alternative	Resources (Bbbl)	Spill Rate (Spills/Bbbl)	Assumed Spill Size (bbl)	Estimated Mean Number of Spills	Estimated Total Spill Volume (bbl)
[illegible]					
No Action	0.0	178	3	0	0
A	0.735	178	3	130	393
B	0.630	178	3	112	336
C	0.0	178	3	0	0
Preferred Alternative	0.630	178	3	112	336
Multiple Sales					
No Action	0.0	178	3	0	0
A	0.735	178	3	130	393
B	0.630	178	3	112	336
C	0.0	178	3	0	0
Preferred Alternative	0.630	178	3	112	336

Note:
[1] The estimated mean number of oil spills is based on the estimated resource volumes multiplied by the spill rate.

Key:
bbl = Barrel(s).
Bbbl = Billion barrels.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-07
Small Crude-Oil Spills: Assumed Size Distribution during Production Life of the Northwest NPR-A for First Sale and Multiple Sales

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			
<1 bbl			
≤1 gal	0 – 25	0 – 20	0 – 20
>1 gal and ≤5 gal	0 – 46	0 – 41	0 – 41
>5 gal and <1 bbl	0 – 26	0 – 22	0 – 22
Total	0 – 97	0 – 83	0 – 83
≥1 bbl and < 500 bbl			
≥1 bbl and ≤5 bbl	0 – 27	0 – 23	0 – 23
>5 and ≤25 bbl	0 – 05	0 – 03	0 – 03
>25 and<500 bbl	0 – 02	0 – 02	0 – 02
Total	0 – 34	0 – 28	0 – 28
Total Volume	0 – 393 bbl	0 – 336 bbl	0 – 336 bbl
	[illegible]	[illegible]	[illegible]
[illegible]			
<1 bbl			
≤1 gal	0 – 25	0 – 20	0 – 20
>1 gal and ≤5 gal	0 – 46	0 – 41	0 – 41
>5 gal and <1 bbl	0 – 26	0 – 22	0 – 22
Total	0 – 97	0 – 83	0 – 83

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≥1 bbl and <500 bbl			
≥1 bbl and ≤5 bbl	0 – 27	0 – 23	0 – 23
>5 and ≤25 bbl	0 – 05	0 – 03	0 – 03
>25 and <500 bbl	0 – 02	0 – 02	0 – 02
Total	**0 – 34**	**0 – 28**	**0 – 28**
Total Volume	**0 – 383 bbl**	**0 – 336 bbl**	**0 – 336 bbl**

Notes:

[1] Spill-size distribution is allocated by multiplying the total estimated number of spills by the fraction of spills in that size category from the State of Alaska, Department of Environmental Conservation database.

[2] Estimated number of spills is rounded to the nearest whole number.

[3] There are no assumed small crude oil spills and therefore no distribution for the No Action Alternative and Alternative C.

Key:
bbl = Barrel.
gal = Gallon.

Source:

USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-08
Small Refined-Oil Spills: Estimated Spill Rate for the Alaska North Slope (1989-2000)

Spill Category	Spill Volume[1]	Number of Spills[1]	Mean Spill Size (bbl)	Production (Crude Oil Bbbl)[2]	Spill Rate (Spills/Bbbl Crude Oil Produced)
Small Refined-Oil Spills	2,243 bbl (94,195 gal)	2,915	0.7	6.6	440

Note:
[1] Oil-spill databases are from the State of Alaska, Department of Environmental Conservation in Anchorage, Juneau, and Fairbanks, BP Exploration (Alaska) Inc., and ARCO.
[2] North Slope production data is derived from the TAPS throughput data from Alyeska Pipeline Company.

Key:
bbl = Barrel.
Bbbl = Billion barrels.
gal = Gallon.

Source: USDOI, MMS, Alaska OCS Region, 2002.

Table App 9-09
Small Refined-Oil Spills <500 bbl Estimated Over the Production Life of Northwest NPR-A: by Alternative

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
First Sale ($18-$30/bbl)					
No Action	0.0 – 0.0		0.7[2]	0 – 0	0 – 0
A	0.0 – 0.735		0.7[2]	0 – 323	0 – 226
B	0.0 – 0.630		0.7[2]	0 – 277	0 – 194
C	0.0 – 0.0		0.7[2]	0 – 0	0 – 0
Preferred Alternative	0.0 – 0.630		0.7[2]	0 – 277	0 – 194
Multiple Sales ($18-$30/bbl)					
No Action	0.0 – 0.0		0.7[2]	0 - 0	0 - 0
A	0.0 – 0.0		0.7[2]	0 -323	0 - 226
B	0.0 – 0.0		0.7[2]	0 - 277	0 - 194
C	0.0 – 0.735		0.7[2]	0 - 0	0 - 0
Preferred Alternative	0.0 – 0.630		0.7[2]	0 – 277	0 – 194

Notes:

[1] The fractional estimated mean spill number and volume are rounded to the nearest whole number.

[2] The mean spill size for refined spills on the Alaska North Slope 1989-2000. Equivalent to 29 gallons.

Key:

bbl = Barrel(s).
Bbbl = Billion barrels.
< = Less Than.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-10
Fate and Behavior of a Hypothetical 500-bbl Oil Spill from Lagoon Pipelines in Alternative A, Alternative B, and the Preferred Alternative[1, 2]

[illegible]	[illegible]				[illegible]			
Time After Spill in Days	1.0	3.0	10.0	30.0	1.0	3.0	10.0	30.0
Oil Remaining (percent)	75.4	68.0	44.0	38.0	77.0	71.9	64.3	57.6
Oil Dispersed (percent)	0.6	2.0	8.0	22.0	0.0.0	0.1	0.7	2.4
Oil Evaporated (percent)	24.0	30.0	36.0	40.0	23.0	28.0	35.0	40.0
Thickness (mm)	3.1	1.9	1.1	1.0	4.6.0	2.7	1.5	1.0
Discontinuous Area (km^2)[5]	1.0	5.0	25.0	103.0	1.0	7.0	17.0	134.0
Estimated Coastline Oiled (km)[6]		17				16		

Notes:

[1] No spills are estimated for any alternative at the $18/bbl price and the No Action Alternative and Alternative C at the $30/bbl price.

[2] Calculated with the Sintef oil-weathering model Version 2.0 of Reed et al. (2000) and assuming an Alpine crude type.

[3] Summer (July through September) assumes: 12-knot wind speed, 2 degrees Celsius, and 0.4-meter wave height.

[4] Spill is assumed to occur in May into first-year ice, pools 2 centimeters thick on ice surface for 2 days at 0 degrees Celsius before meltout into 50% ice cover, 11-knot wind speed, and 0.1-meter wave heights.

[5] Calculated from Equation 6 of Table 2 in Ford (1985) and is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume. Ice dispersion occurs for about 30 days before meltout.

[6] Calculated from Equation 17 of Table 4 in Ford (1985) and is the result of stepwise multiple regression for length of historical coastline affected.

Key:

km = Kilometer.
km^2 = Square kilometer.
mm = Millimeter.

Source:
USDOI, MMS, Alaska OCS Region, 2002.
Meltout Spill[4]

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Table App 9-11
Fate and Behavior of a Hypothetical 900-bbl Oil Spill from a Lagoon Facility in Alternative A, Alternative B, and the Preferred Alternative[1, 2]

	Summer Spill[3]				Meltout Spill[4]			
Time After Spill in Days	1	3	10	30		3	10	30
Oil Remaining (percent)	75.5	68.4	57.9	40	76.9	71.8	64	56.5
Oil Dispersed (percent)	0.5	1.6	6.1	20	0.1	0.2	1	3.5
Oil Evaporated (percent)	24	30	36	40	23	28	35	40
Thickness (mm)	4.1	2.5	1.5	1	6.1	3.9	1.9	1.2
Discontinuous Area (km²)[5]	1	7	34	140	2	9	43	181
Estimated Coastline Oiled (km)[6]		22					21	

Notes:

[1] No spills are estimated for any alternative at the $18/bbl price and the No Action Alternative and Alternative C at the $30/bbl price.

[2] Calculated with the Sintef oil-weathering model Version 2.0 of Reed et al. (2000) and assuming an Alpine crude type.

[3] Summer (July through September) assumes: 12-knot wind speed, 2 degrees Celsius, and 0.4-meter wave height.

[4] Spill is assumed to occur in May into first-year ice, pools 2 centimeters thick on ice surface for 2 days at 0 degrees Celsius before meltout into 50% ice cover, 11-knot wind speed, and 0.1-meter wave heights.

[5] Calculated from Equation 6 of Table 2 in Ford (1985) and is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume. Ice dispersion occurs for about 30 days before meltout.

[6] Calculated from Equation 17 of Table 4 in Ford (1985) and is the result of stepwise multiple regression for length of historical coastline affected.

Key:

km = Kilometer.
km² = Square kilometer.
mm = Millimeter.

Source:

USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-12
Oil Spill Rates and Spill-Size Categories used to Estimate Large Crude Oil Spills for the Cumulative Analysis

	[illegible]		[illegible]		[illegible]		[illegible]	
	Spill Rate (Spills/Bbbl)	Size Category (bbl)	Spill Rate (Spills/Bbbl)	Size Category (bbl)	Spill Rate (Spills/Bbbl)	Size Category (bbl)	Spill Rate (Spills/Bbbl)	Size Category (bbl)
Offshore	0.23[1]	≥1,000	-	-	-	-	0.88[2]	≥1,000
Onshore		-	0.64	≥500	0.21	≥500	-	-

Notes:

[1] Bercha Group Inc., 2002; Anderson, 2002.

[2] Anderson and LaBelle, 2000.

Key:

≥ = Greater Than or Equal To.
TAPS = Trans-Alaska Pipeline System.
bbl = Barrel(s).
Bbbl = Billion barrels.
OCS = Outer Continental Shelf.
— = Not Applicable.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-13
Resources and Reserves used to Estimate Large Crude Oil Spills for the Cumulative Analysis

	[illegible]		
	Total	**Onshore**	**Offshore**
North Slope[2] Past and Present Production			
Past Production	5.294	4.938	0.356
Present Production	0.138	0.138	—[1]
Total	**5.432**	**5.076**	**0.356**
North Slope[2] Reasonably Foreseeable Future Production			
Discovered	1.570	0.500	1.070
Undiscovered	3.680	2.300	1.380
Total	**5.250**	**2.800**	**2.450**
North Slope[2] Past, Present and Reasonably Foreseeable Production			
North Slope Subtotal	**10.682**	**7.876**	**2.806**
NW NPR-A	**0.370**	**0.370**	**—**
Total	**11.052**	**8.246**	**2.806**

Notes:
[1] No present offshore production.
[2] Without Northwest NPR-A.
— = Not applicable.

Key:
Bbbl = Billion barrels.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-14

Cumulative Oil-Spill-Occurrence Estimates ≥500 bbl and ≥1,000 bbl over Assumed 15-20 Year Production Life of Northwest NPR-A

[illegible]	Reserves and Resources (Bbbl)	Spill Rate (Spills/Bbbl)	Size Category	Assumed Size (bbl)	Most Likely Number	Estimated Mean Number of Spills
Offshore						
Past, Present, and Reasonably Foreseeable	2.81	0.23	≥ 1000 bbl	—	0	0.65
Northwest NPR-A Planning Area	—	0.23	≥ 1000 bbl	—	—	—
Total	**2.81**	**0.23**	≥ 1000 bbl	—	**0**	**0.65**
Onshore						
Past, Present, and Reasonably Foreseeable	7.88	0.64	≥ 500 bbl	500-900	5	5.04
Northwest NPR-A Planning Area	0.37	0.64	≥ 500 bbl	500-900	0	0.24
Total	**8.25**	**0.64**	≥ 500 bbl	500-900	**5**	**5.28**
TAPS (Pipeline)						
Past, Present, and Reasonably Foreseeable	10.68	0.21	≥ 500 bbl	4,400	2	2.24
Northwest NPR-A Planning Area	0.37	0.21	≥ 500 bbl	4,400	0	0.08
Total	**11.05**	**0.21**	≥ 500 bbl	4,400	**2**	**2.24**
TAPS (Tanker)						
Past, Present, and Reasonably Foreseeable	10.68	0.88	≥ 1,000 bbl	Table App 9-15	9	9.40
Northwest NPR-A Planning Area	0.37	0.86	≥ 1,000 bbl	Table App 9-15	0	0.32
Total	**11.05**	**0.88**	≥ 1,000 bbl	Table App 9-15	**9**	**9.72**

Note:

The Alaska Dept. of Environmental Conservation database has no significant crude oil spills on the North Slope resulting from well blowouts and no facility or onshore pipeline spills greater than 1,000 barrels for the years 1985-2000.

Key:

bbl = Barrel(s).
Bbbl = Billion barrels.
— = Data not available or not applicable.

Source: USDOI, MMS, Alaska OCS Region, 2002.

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Table App 9-15
Estimated Number of Trans-Alaska Pipeline System Tanker Spills, Assumed Sizes and Estimated Volumes

[illegible] (bbl)	Estimated Number	Assumed Size (bbl)	Total Volume (bbl)
≤6,000	6	4,000	24,000
>6,000and ≤15,000	2	13,000	26,000
>15,000	1	250,000	250,000
Total	9	—	294,000

Notes:
The distribution of the number of spills is based on the percentage of the number of spills in a similar size category from historic Trans-Alaska Pipeline System tanker spills listed in Table App9-03. The table indicates that 63% are ≤6,000 barrels; 27% are > 6,000 and ≤15,000 barrels; and 9% are >15,000 barrels.

Key:
bbl = Barrel(s).
≤ = Less Than or Equal To.
> = Greater Than.

Source:
USDOI, MMS, Alaska OCS Region, 2002.

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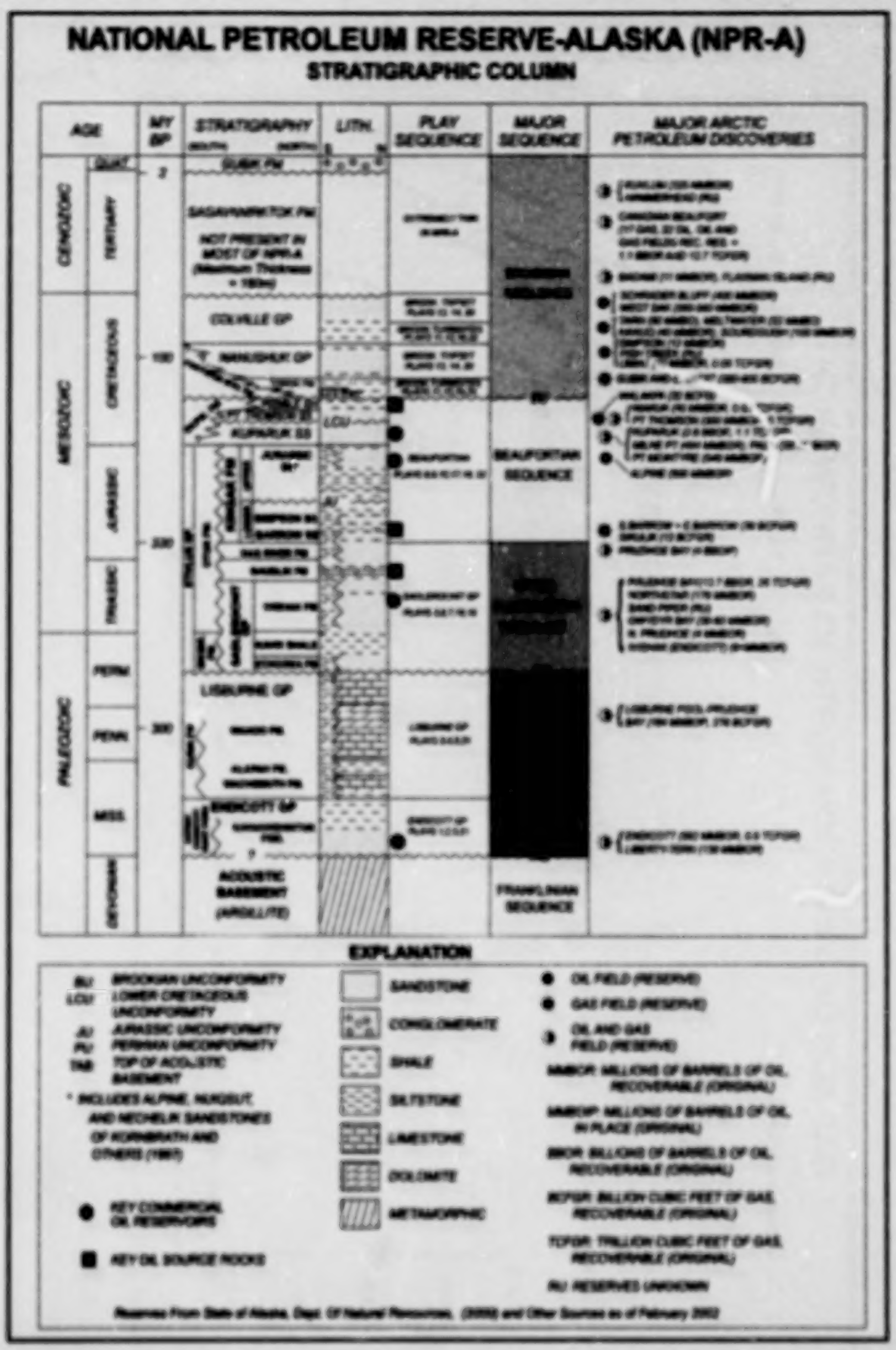

Figure III-01. **Stratigraphic column for NPR-A.** Schematic showing geologic ages, stratigraphic nomenclature, play sequences (used in the oil and gas assessment), and reservoirs for North Slope and Canadian Beaufort oil and gas fields with a tabulation of original reserves.

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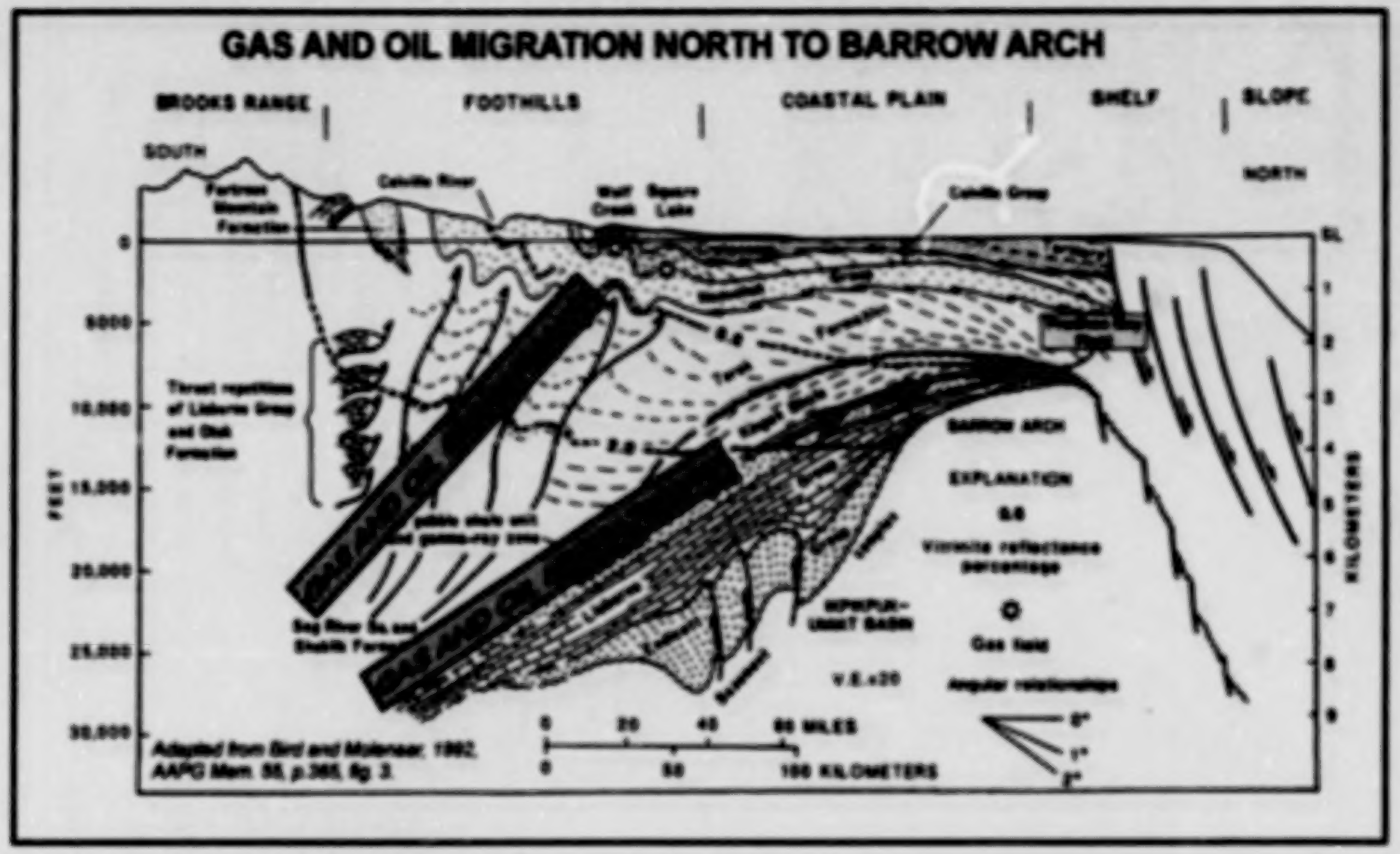

Adapted from Bird and Molenaar, 1992, AAPG Mem. 55, p.365, fig. 3.

Figure III-02. Regional Schematic Cross-Section. Regional schematic cross section showing patterns of migration of oil and gas from generation areas deep beneath the Colville basin (Foothills) north toward Barrow arch.

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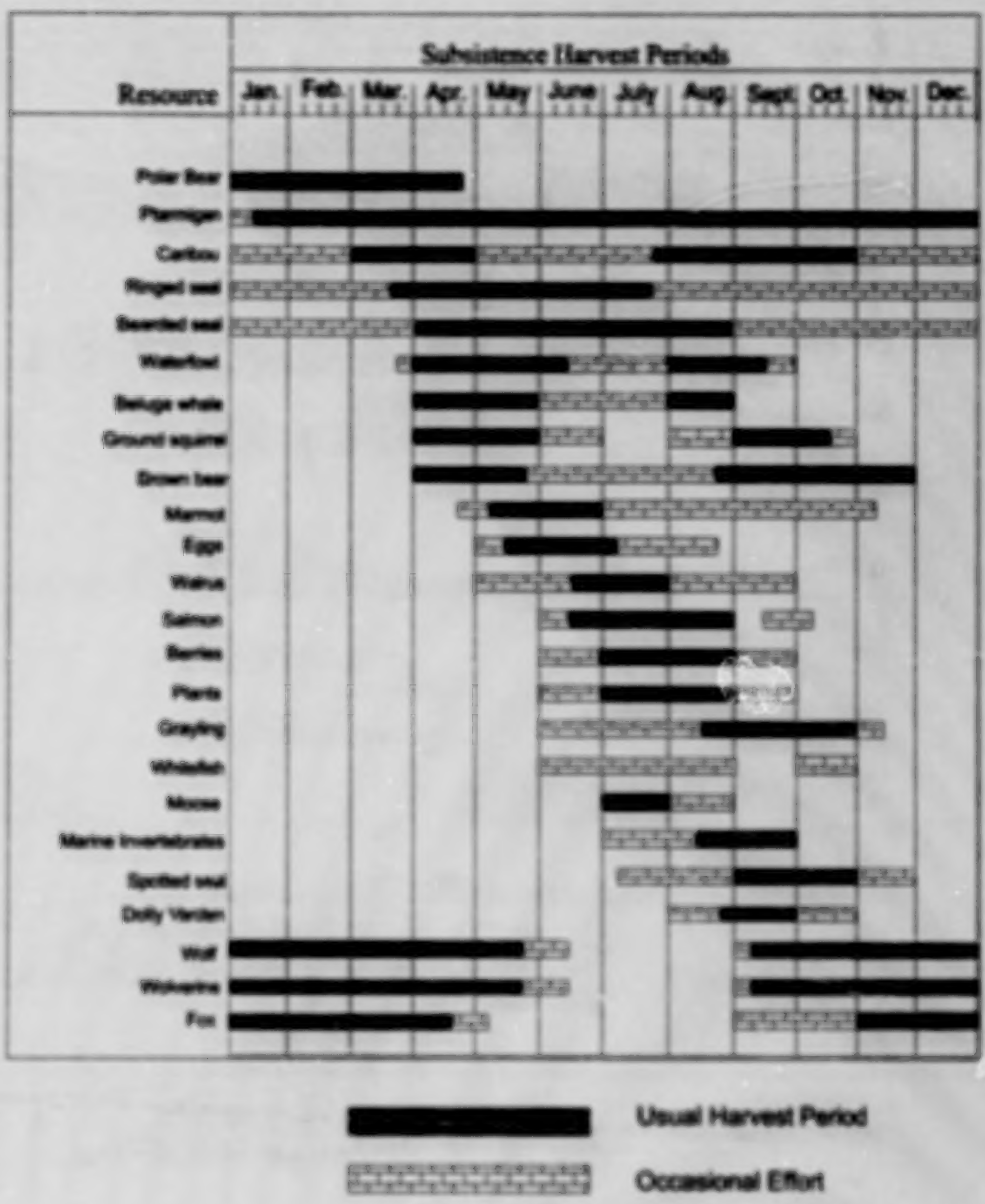

Source: Pedersen, 1979 and North Slope Borough Contract Staff, 1979.

Figure III-03. Point Lay Annual Subsistence Cycle.

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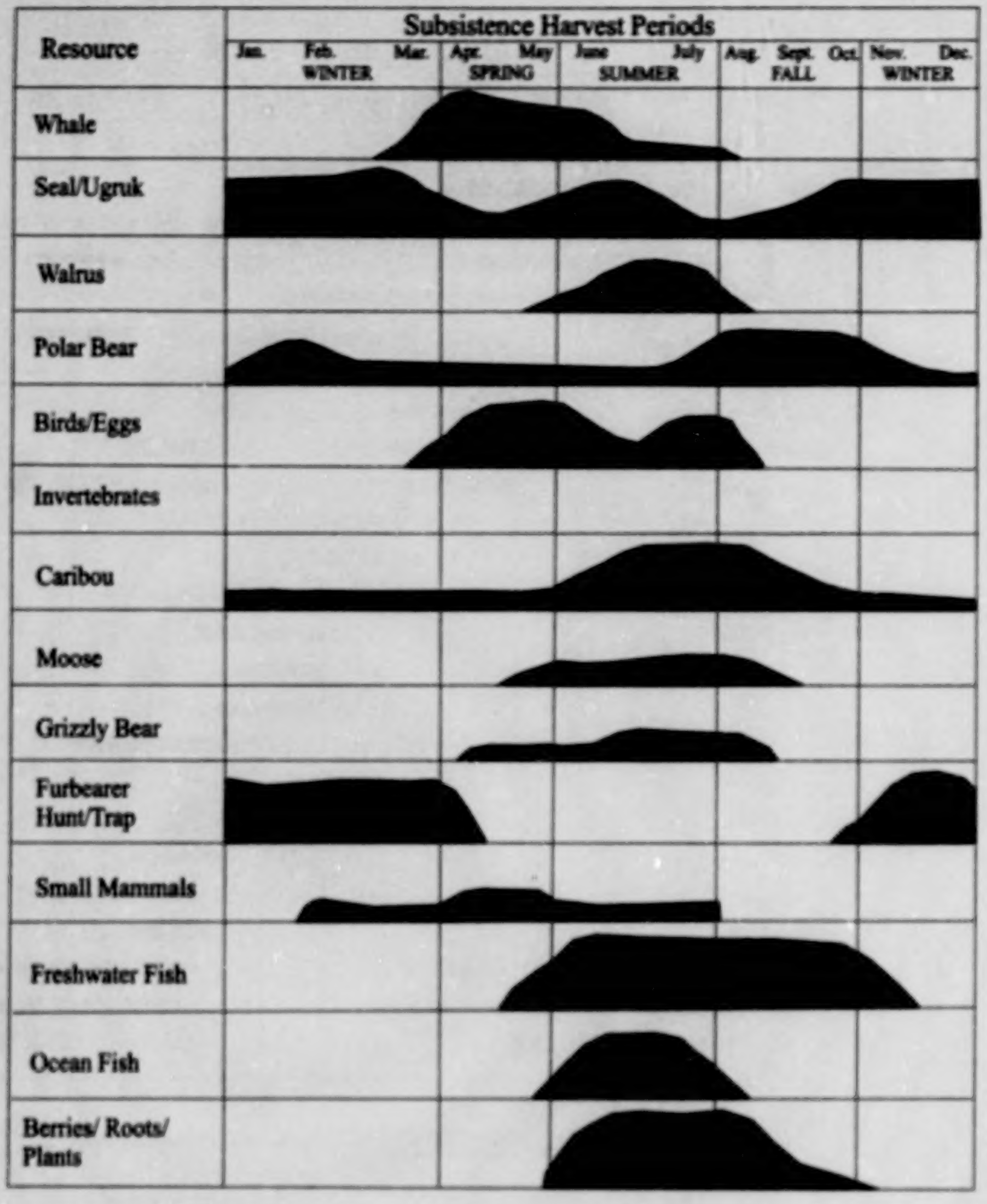

Source: USDOI, MMS, Alaska OCS Region, 1990.

Figure III-04. Wainwright Annual Subsistence Cycle. Patterns indicate desired periods for pursuit of each species based on the relationship of abundance, hunter access, seasonal needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources.

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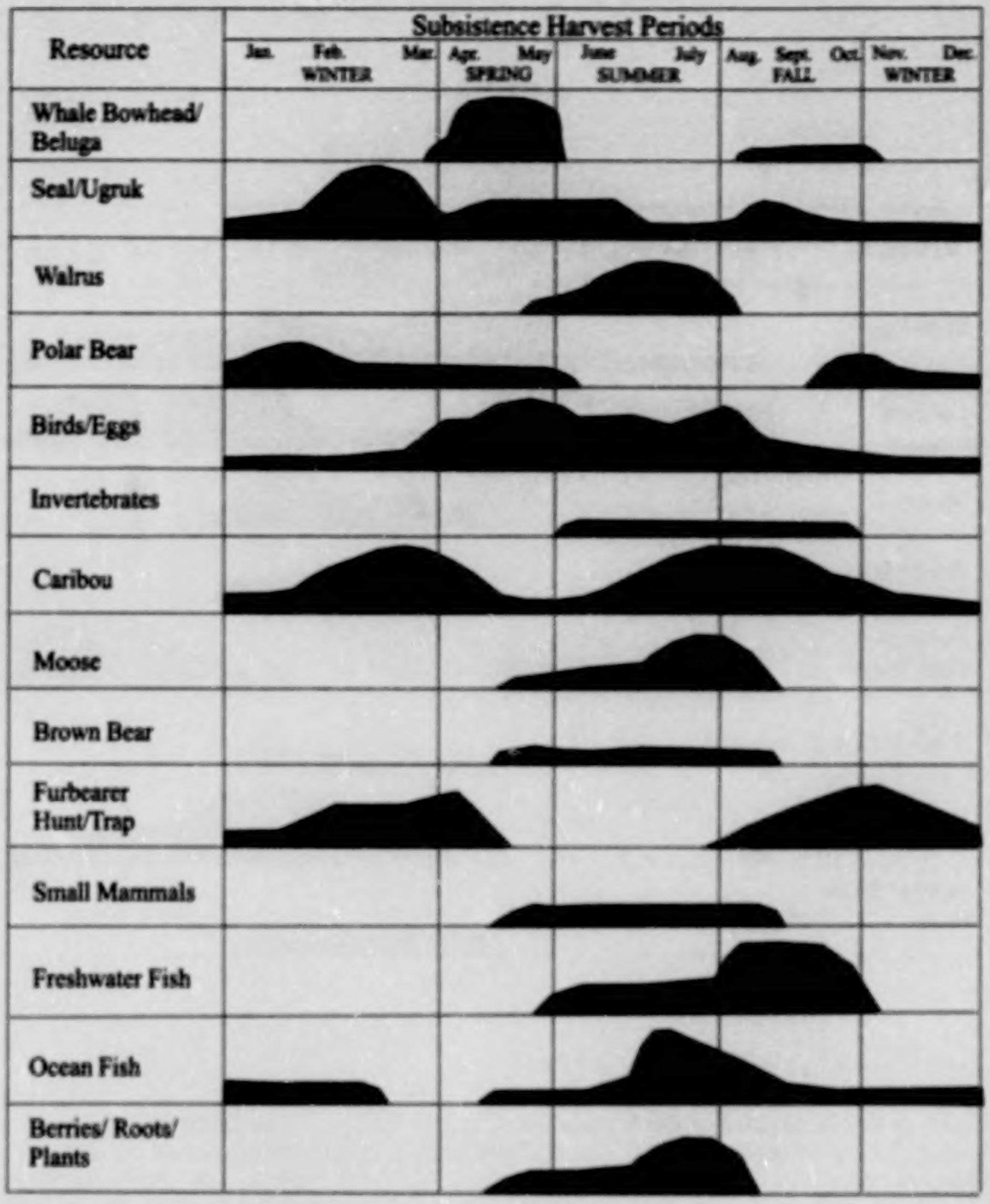

Source: Pedersen, 1979 and North Slope Borough Contract Staff, 1979.

Figure III-05. Barrow Annual Subsistence Cycle. Patterns indicate desired periods for pursuit of each species based on the relationship of abundance, hunter access, seasonal needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources. (Data for invertebrates, sheep, and ocean fish are unavailable.)

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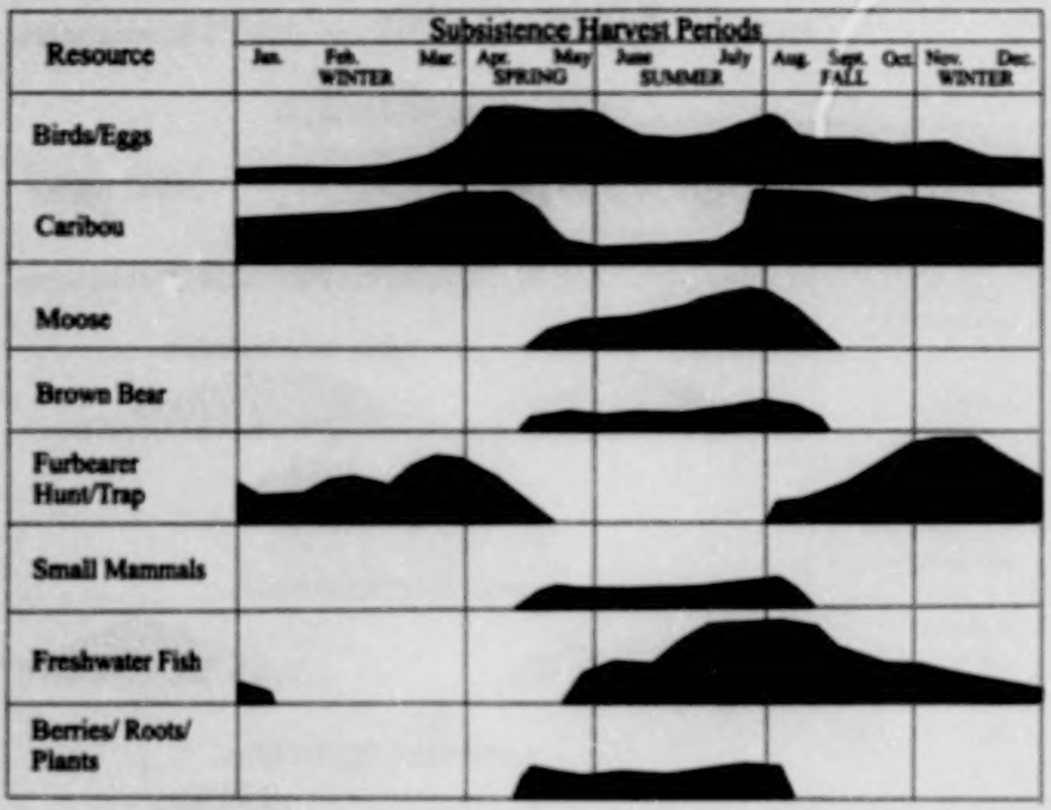
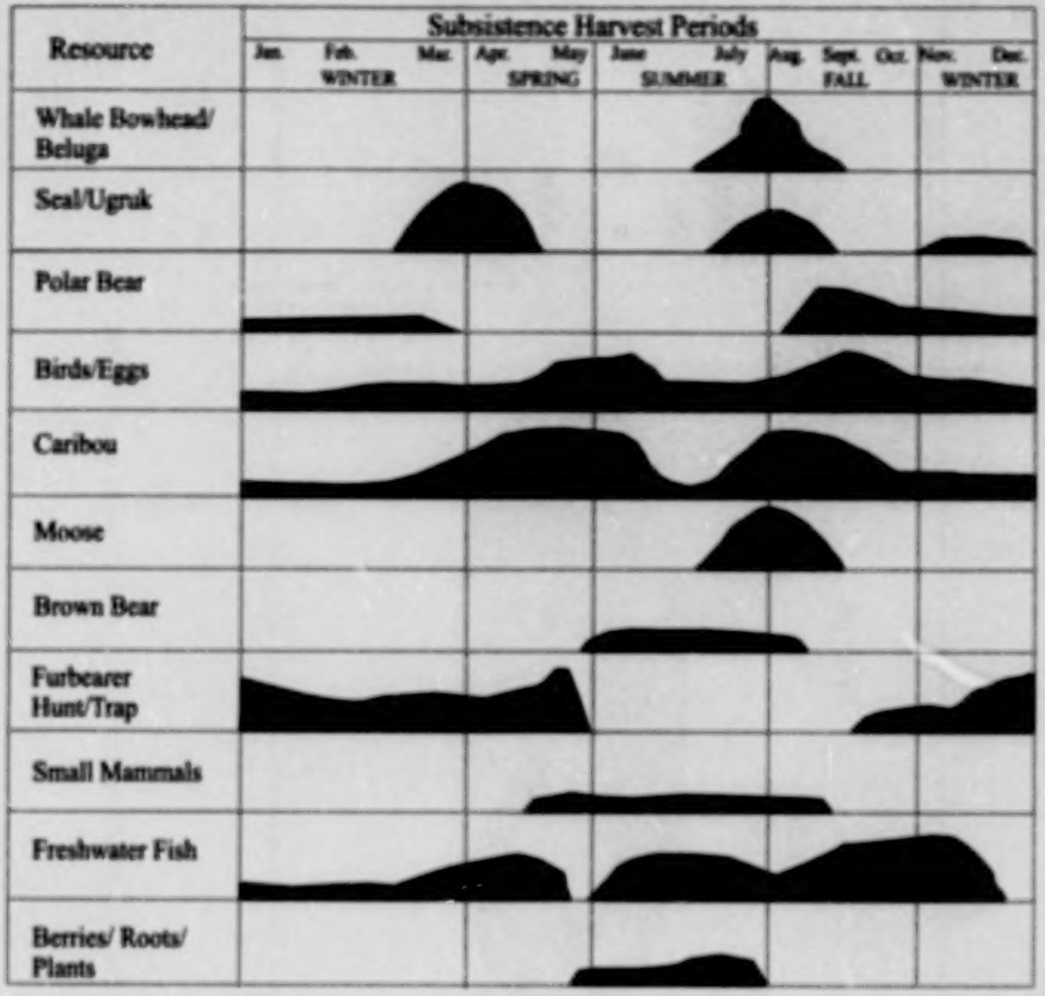


Source: North Slope Borough Contract Staff (1979).

Figure III-06. Atqasuk Annual Subsistence Cycle. Patterns indicate desired periods for pursuit of each species based upon the relationship of abundance, hunter access, seasonal needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources. (Data for sheep are unavailable. Whales, seal, walrus, Polar bear, invertebrates, and ocean fish are harvested only out of hunts originating in Barrow.)



Source: North Slope Borough, Contract Staff, 1979.

Figure III-07. Nuiqsut Annual Subsistence Cycle. Patterns indicate desired periods for pursuit of each species based upon the relationship of abundance, hunter access, seasonal needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources. (Data for invertebrates, sheep, and ocean fish are unavailable.)

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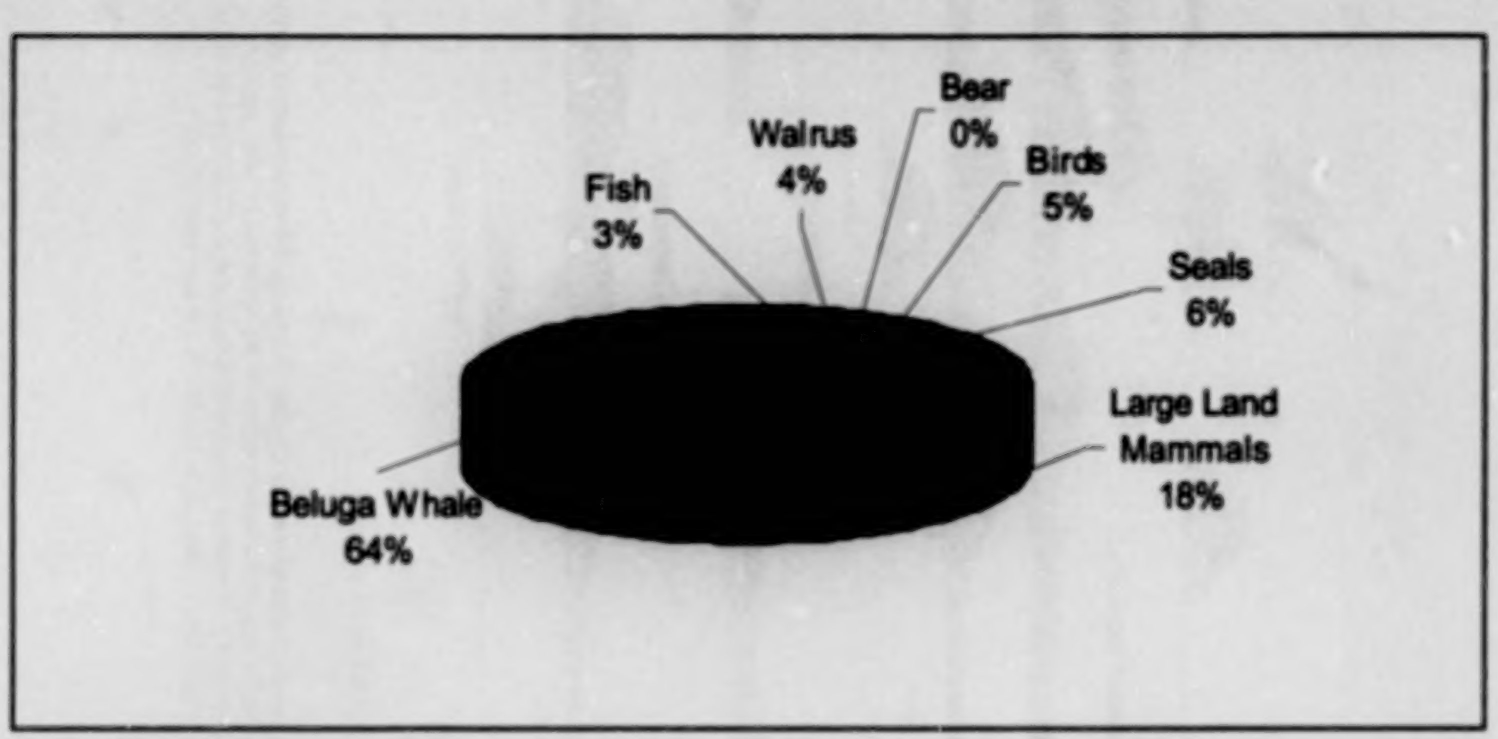

Source: Impact Assessment, inc., 1989c.

Figure III-08. Relative Contribution of Beluga Whale to the Point Lay Subsistence Harvest.

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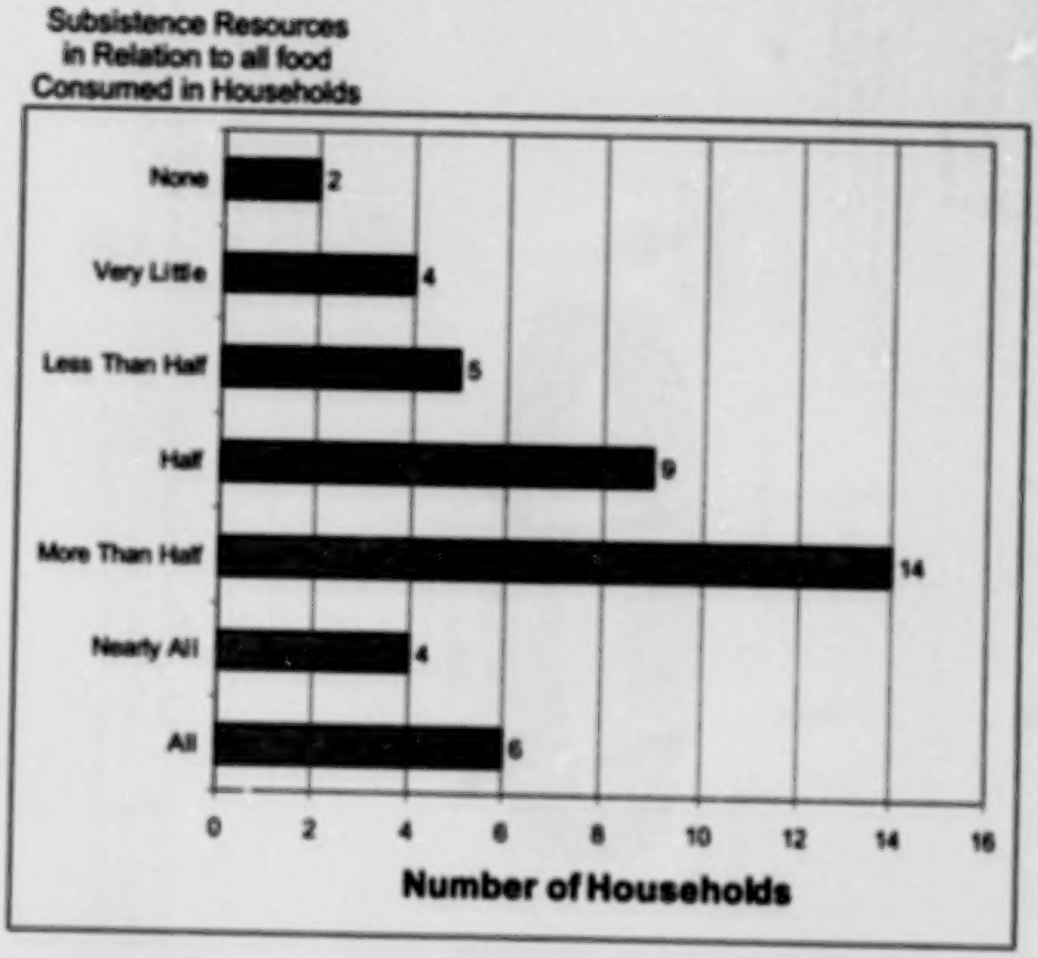
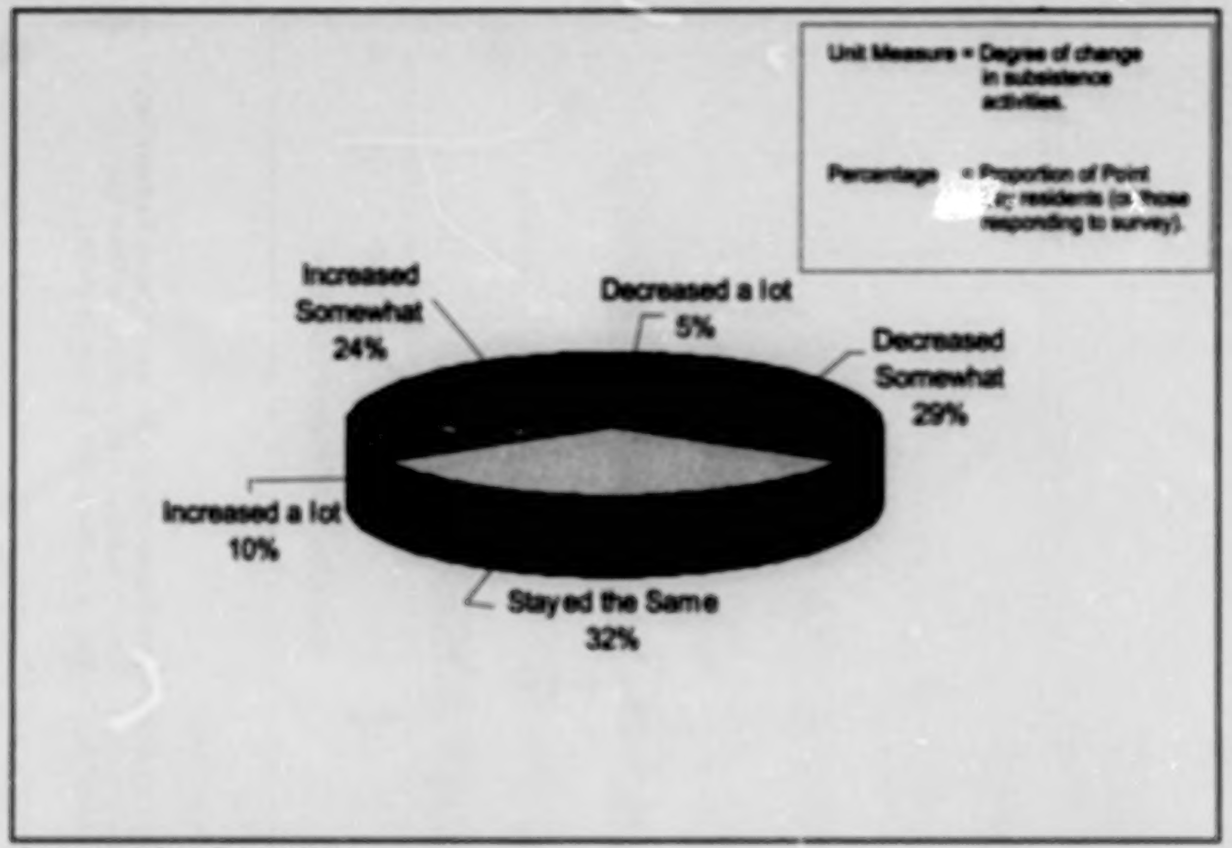


Source: North Slope Borough, 1999.

Figure III-09. Point Lay Household Consumption of Subsistence Resources, 1998-1999. Number represents total ".. number of households in Point Lay indicating they harvested and consumed subsistence resources during the past year."



Source: North Slope Borough, 1999.

Figure III-10. Point Lay Changes in Subsistence Activitiy, 1998-1999. These results include only those households participating in the census survey and answering the question: "How much would you say your subsistence activities have changed over the last 5 years?"

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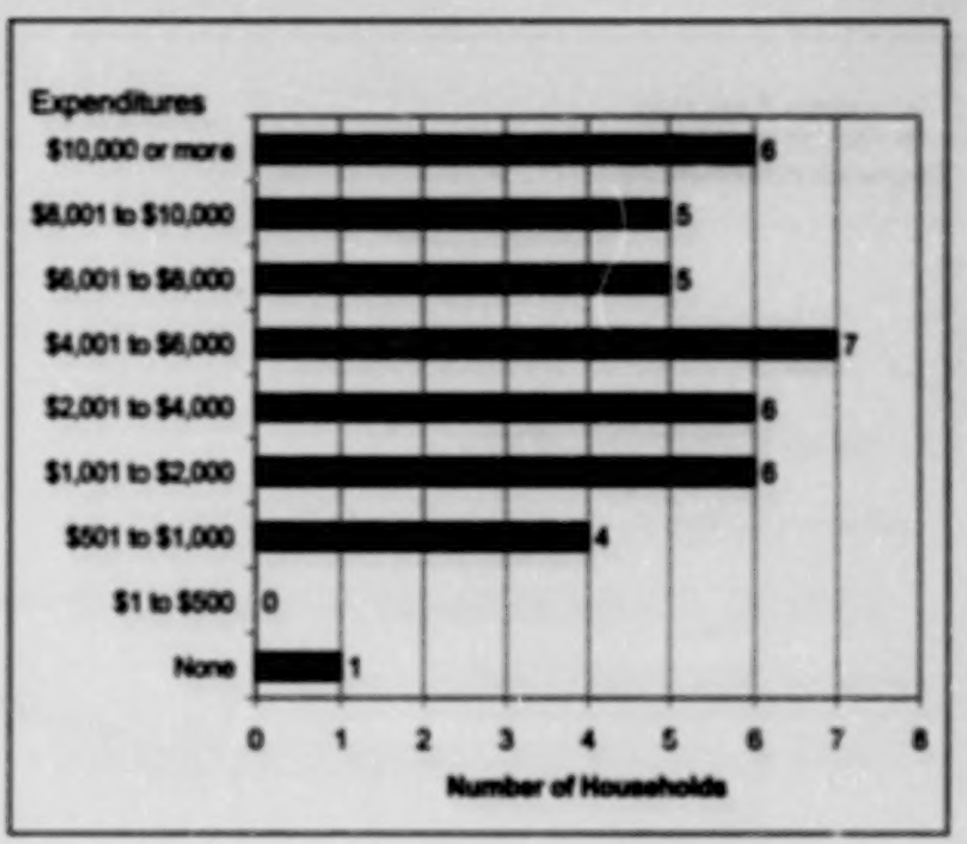
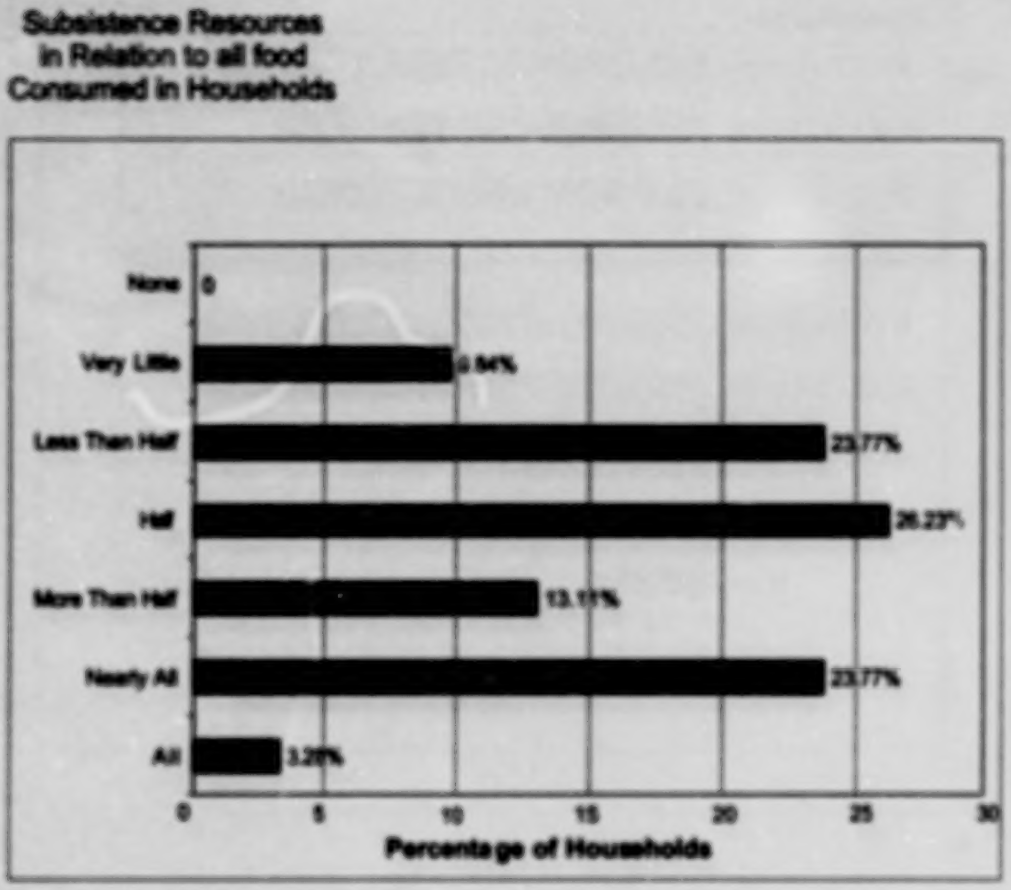


Source: North Slope Borough, 1999.

Figure III-11. Point Lay Expenditures on Subsistence Activities, 1998-1999. Results include only those households participating in the census survey and answering the question, "...what is your best estimate of the money you spent on subsistence activities (during the past calendar year)?"



Source: North Slope Borough, 1999.

Figure III-12. Wainwright Household Consumption of Subsistence Resources, 1998-1999. Percentages are "of the total number of households in Wainwright indicating they harvested and consumed subsistence resources during the past year."

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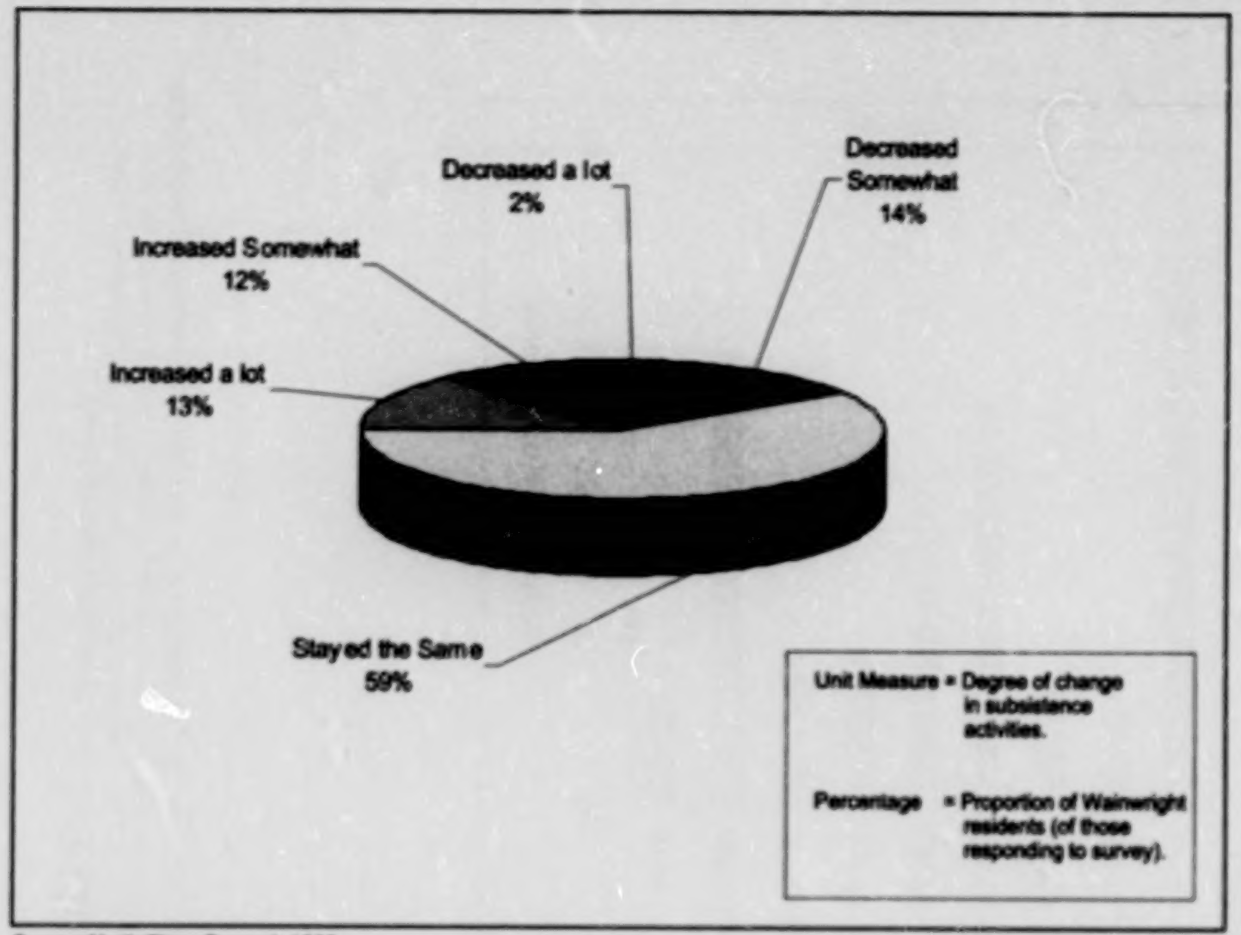

Source: North Slope Borough,1999.

Figure III-13. Wainwright Changes in Subsistence Activity, 1998-1999. Results include only those households participating in the census survey and answering the question: "How much would you say your subsistence activities have changed over the past 5 years?"

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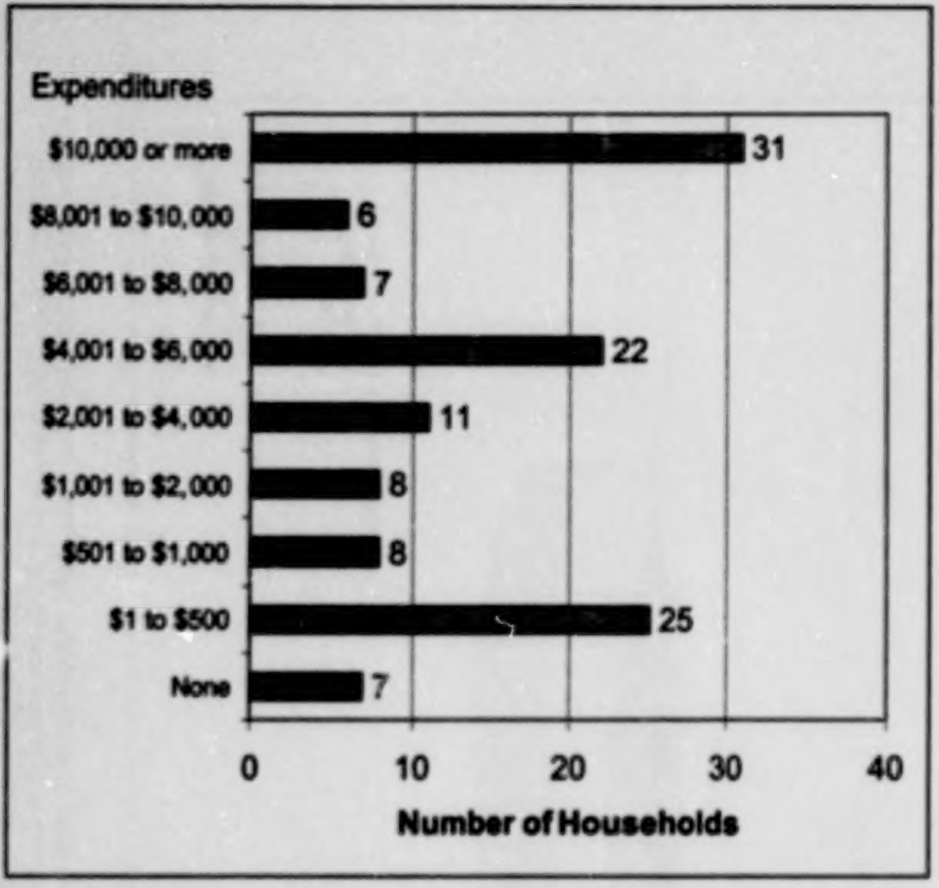

Source: North Slope Borough,1999.

Figure III-14. Wainwright Expenditures on Subsistence Activities, 1998-1999. Results include only those households participating in the census survey and answering the question, "...what is your best estimate of the money you spent on subsistence activities (during the past calendar year)?"

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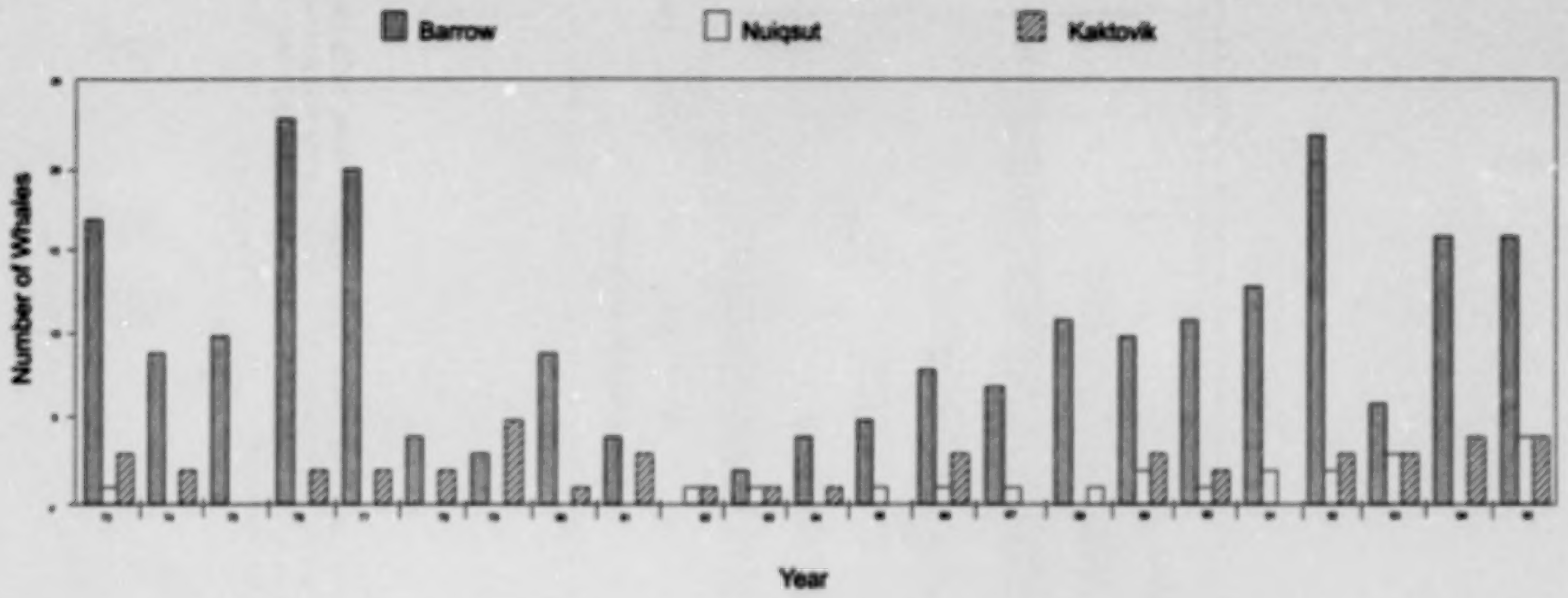

Sources: ACI/Braund (1984); Alaska Eskimo Whaling Commission (1993, 1994, 1995); George et al. (1993); Gusey (1993); Philo et al. (1993); State of Alaska Dept. Of Fish and Game (1993a,b); Stoker and Krupnik (1983).

Figure III-15. Annual Subsistence Harvest of Bowhead Whales by the North Slope Communities of Barrow, Nuiqsut, and Kaktovik, 1973 -1995.

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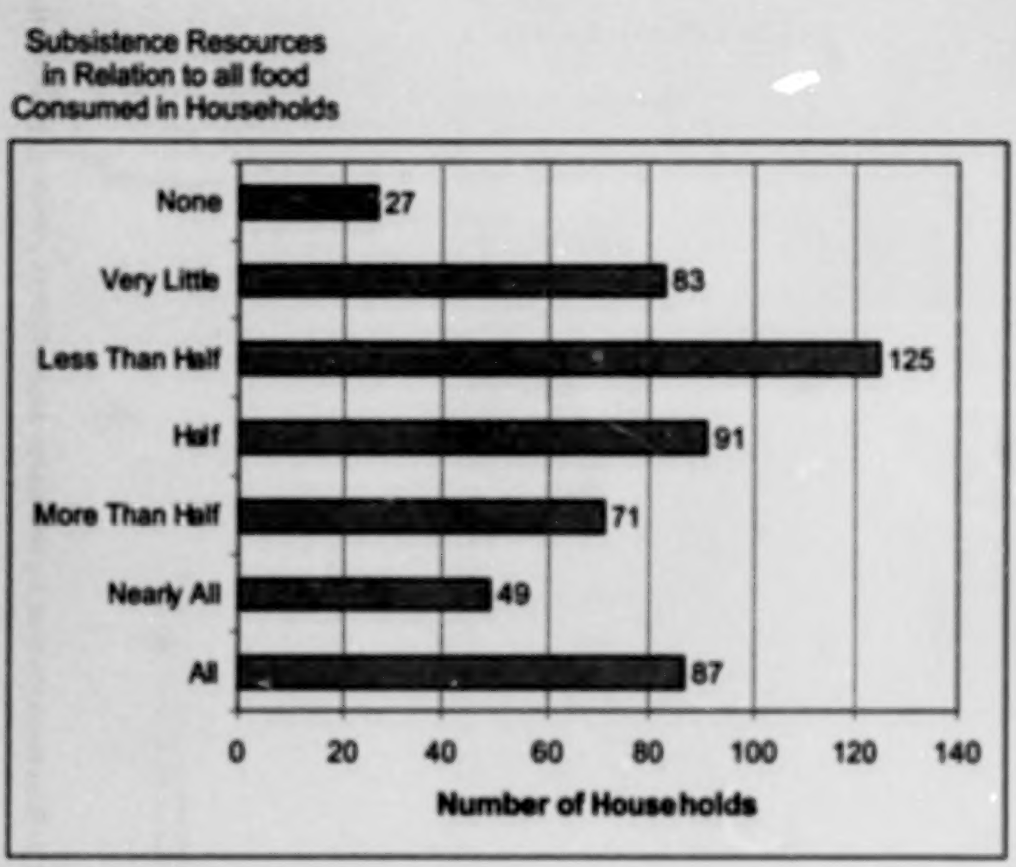

Source: North Slope Borough, 1999.

Figure III-16. Barrow Household Consumption of Subsistence Foods, 1998-1999. Results include only those households participating in the census survey and answering the question: "How much of the meat, fish and birds you and your household ate come from local food sources (fishing and hunting?)"

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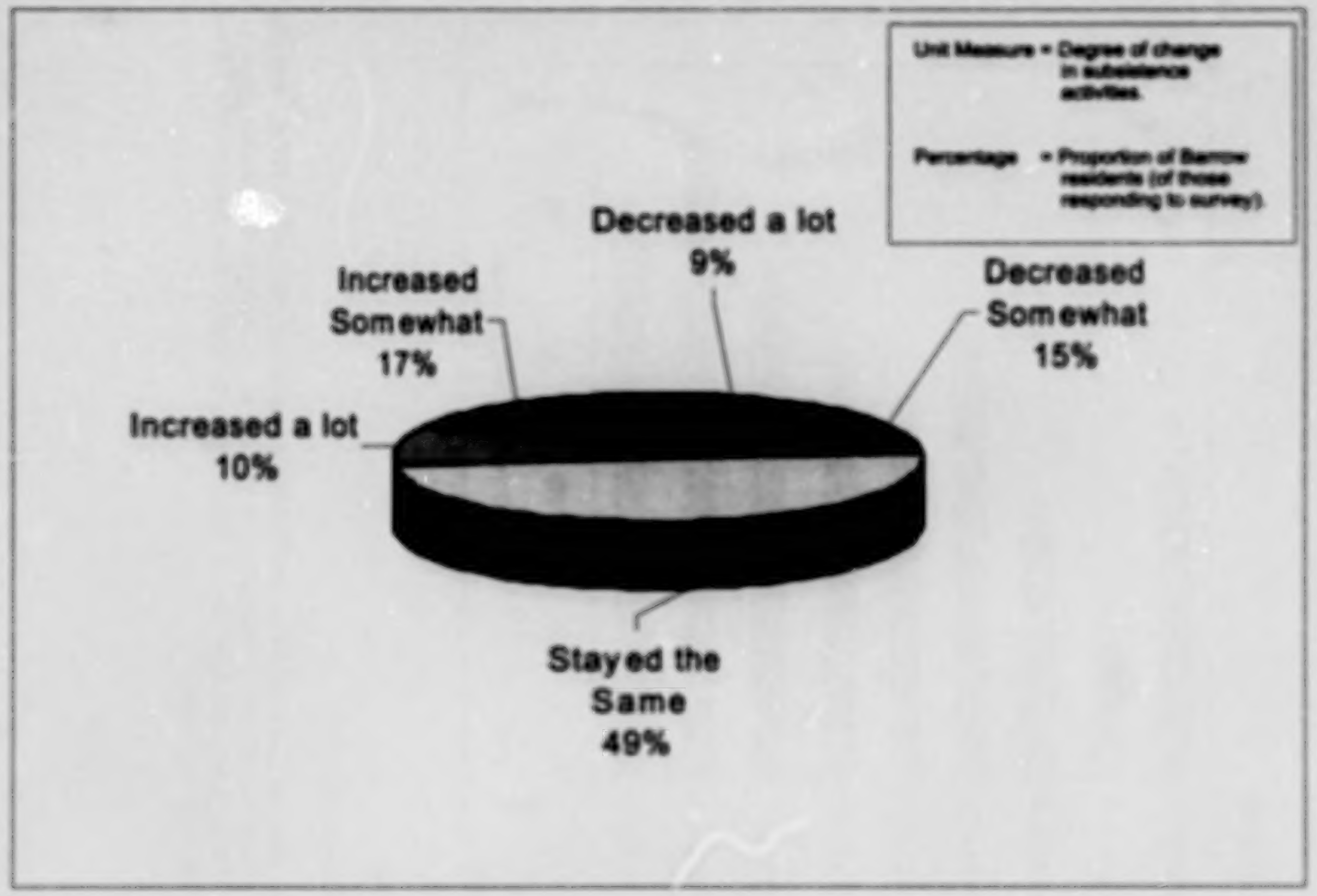
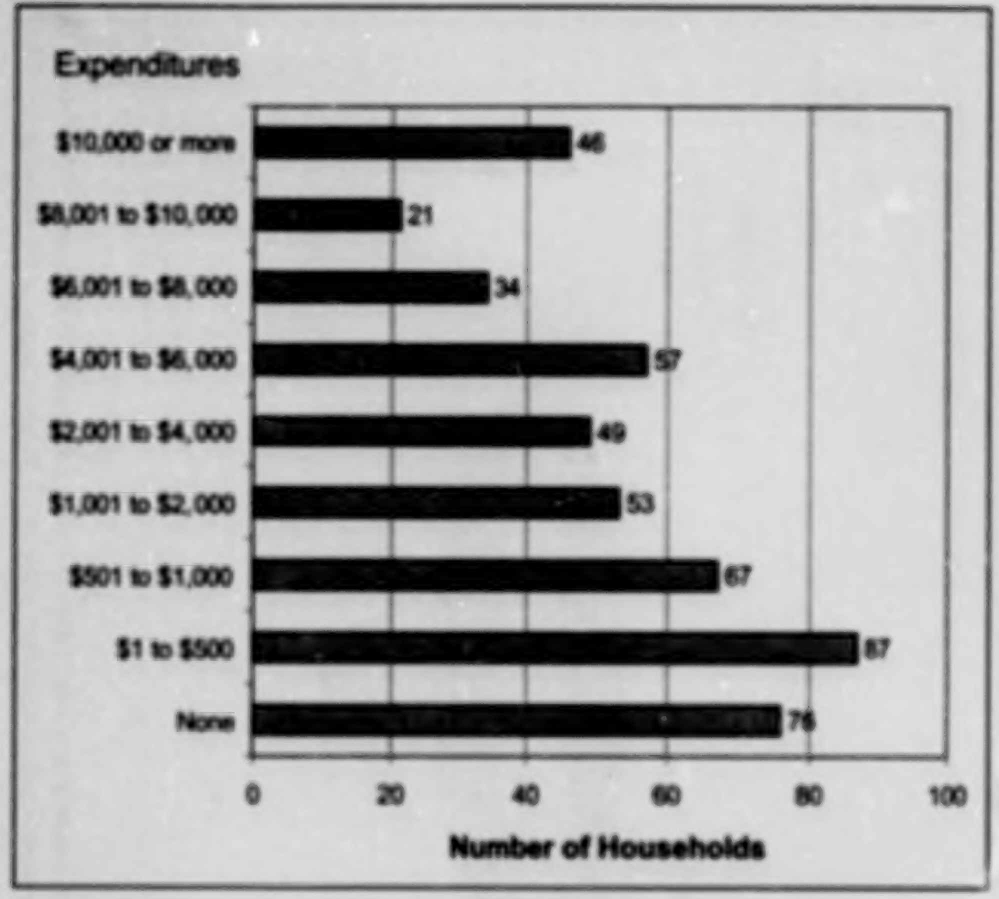


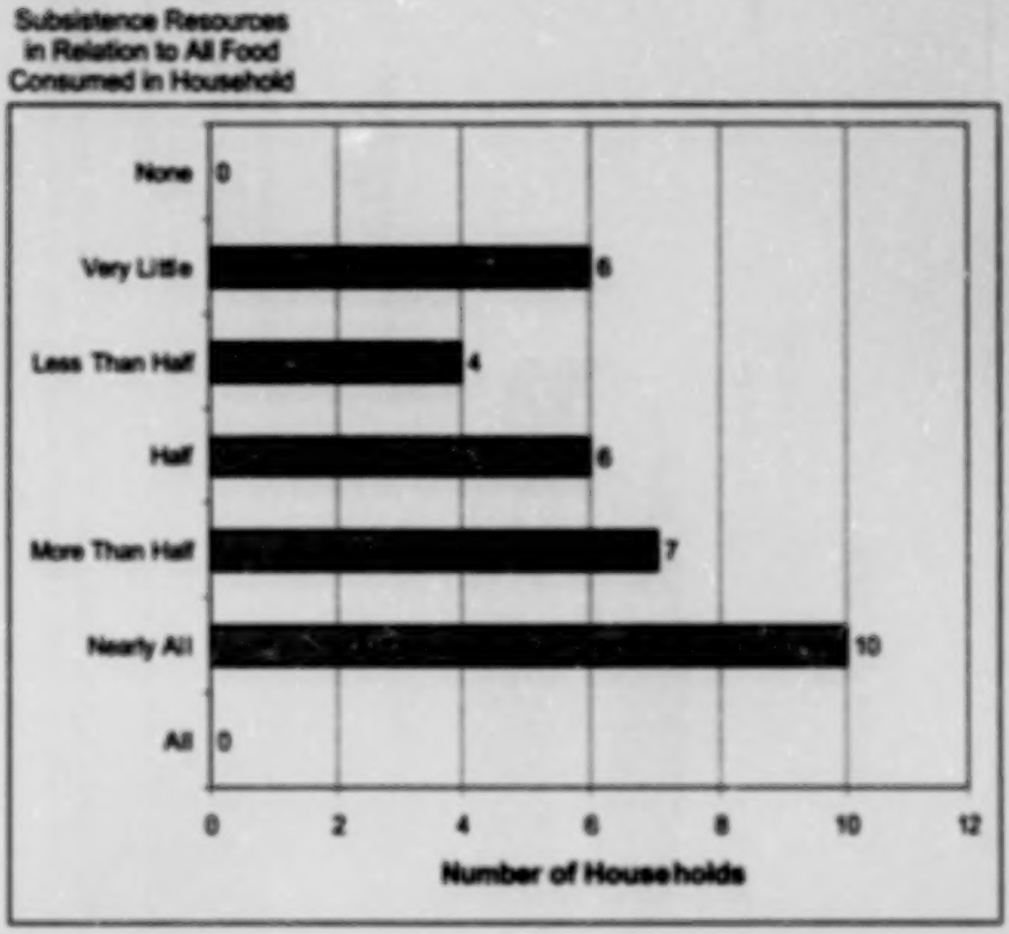
Source: North Slope Borough,1999.

Figure III-17. Barrow Changes in Subsistence Activity, 1998-1999. These results include only those households participating in the census survey and answering the question: "How much would you say your subsistence activities have changed over the past 5 years?".



Source: North Slope Borough, 1999.

Figure III-18. Barrow Expenditures on Subsistence Activities, 1998-1999. Results include only those households participating in the census survey and answering the question, "...what is your best estimate of the money you spent on subsistence activities (during the past calendar year)?"



Source: North Slope Borough,1999.

Figure III-19. Atqasuk Household Consumption of Subsistence Foods, 1998-1999. Results include only those households participating in the census survey and answering the question: "How much of the meat, fish and birds you and your household ate come from local food sources (fishing and hunting)?"

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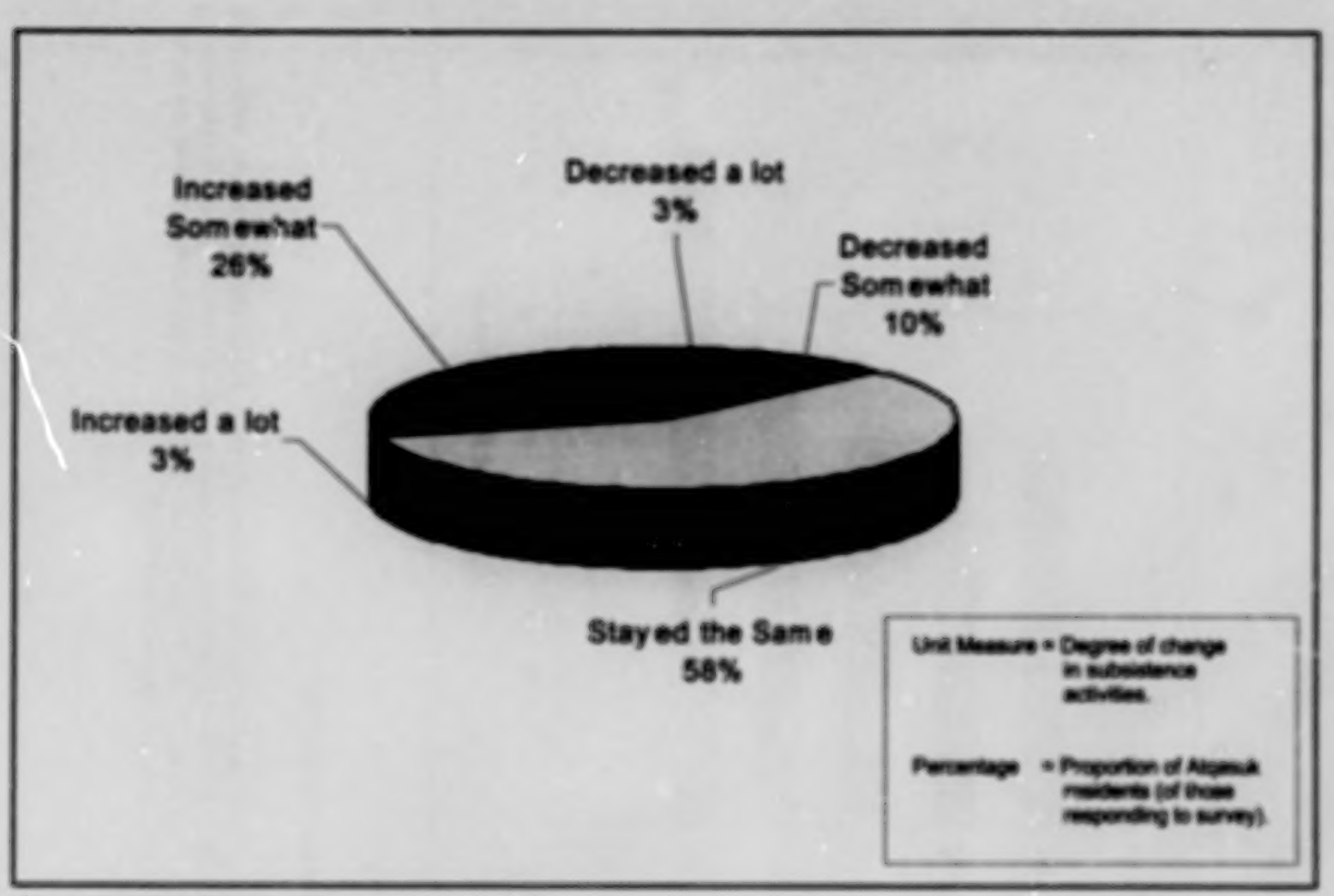

Source: North Slope Borough,1999.

Figure III-20. Atqasuk Changes in Subsistence Activity, 1998-1999. These results include only those households participating in the census survey and answering the question: "How much would you say your subsistence activities have changed over the past 5 years?"

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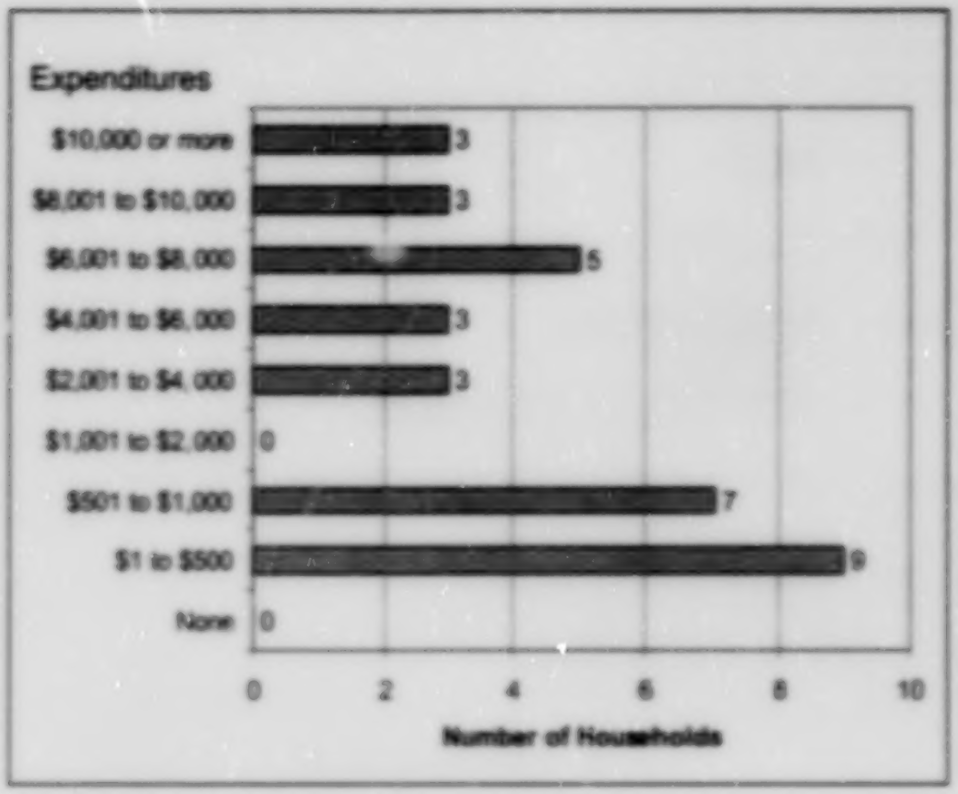
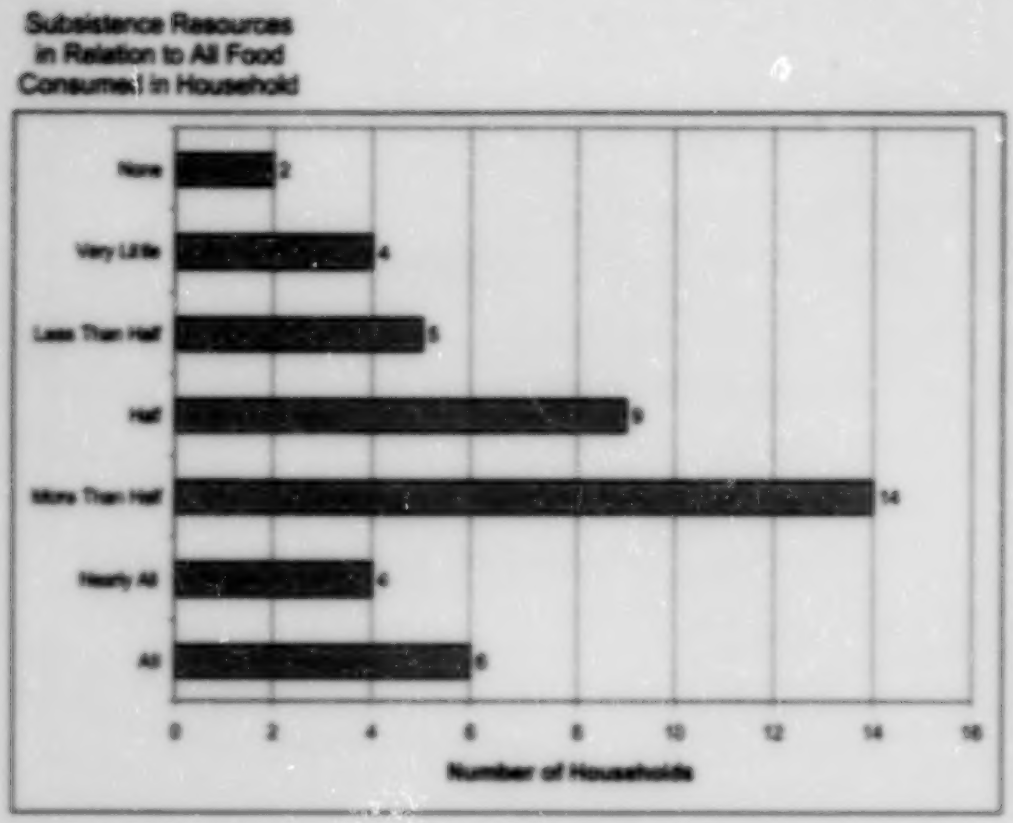


Source: North Slope Borough, 1999.

Figure III-21. Atqasuk Expenditures on Subsistence Activities, 1998-1999. Results include only those households participating in the census survey and answering the question, "...what is your best estimate of the money you spent on subsistence activities (during the past calendar year)?"



Source: North Slope Borough, 1999.

Figure III-22. Nuiqsut Household Consumption of Subsistence Foods, 1998-1999. Number represents "... the total number of households in Nuiqsut indicating they harvested and consumed subsistence resources during the past calendar year."

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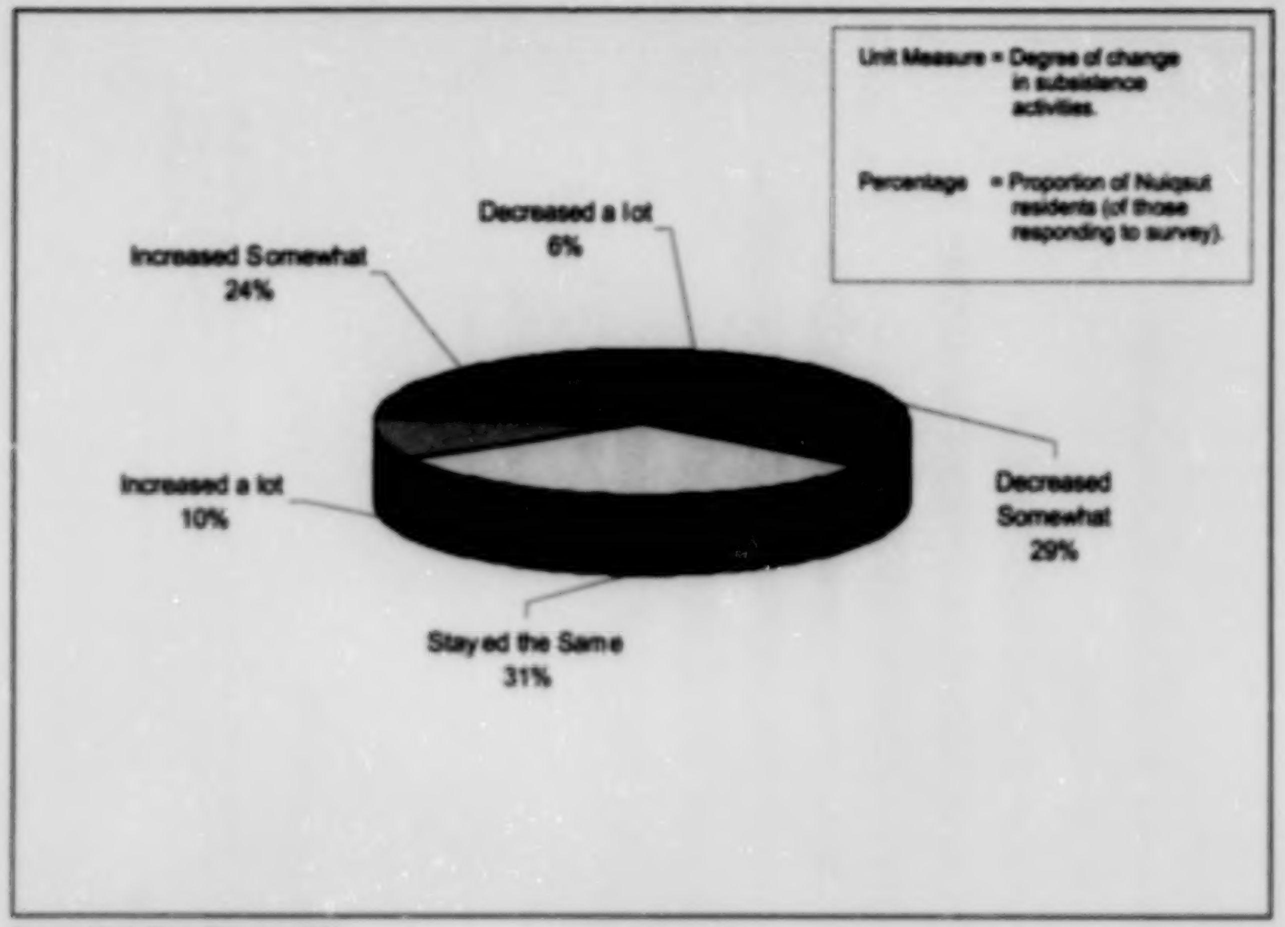
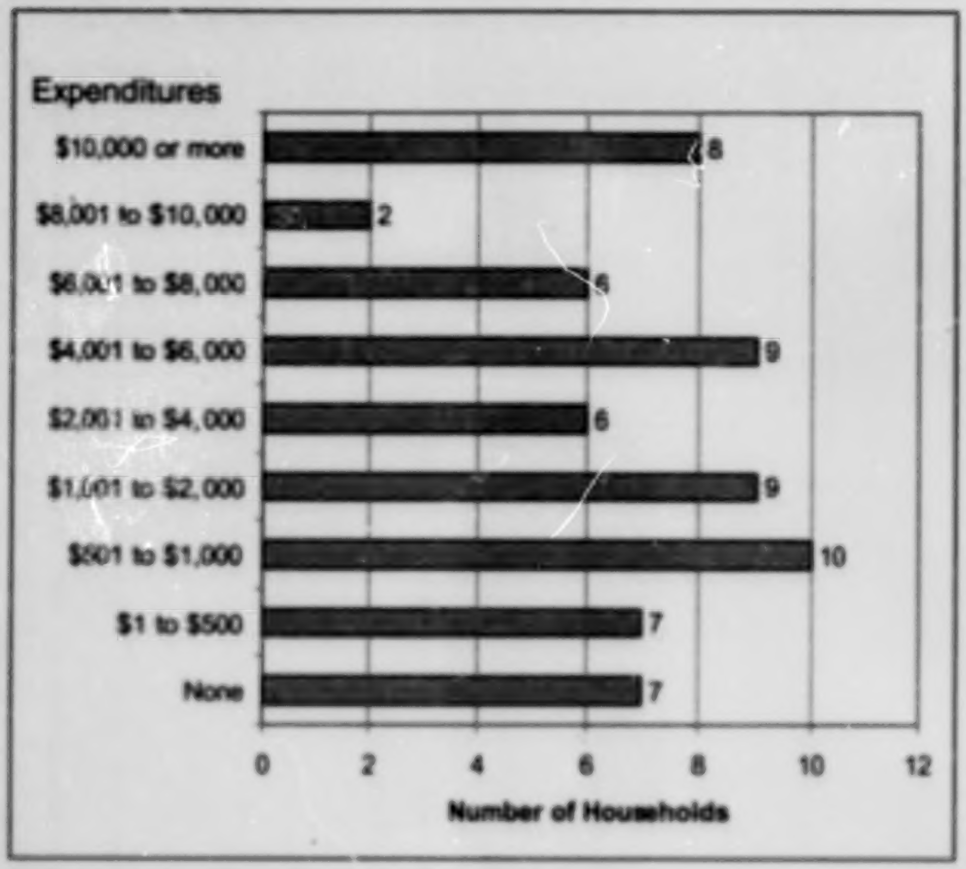


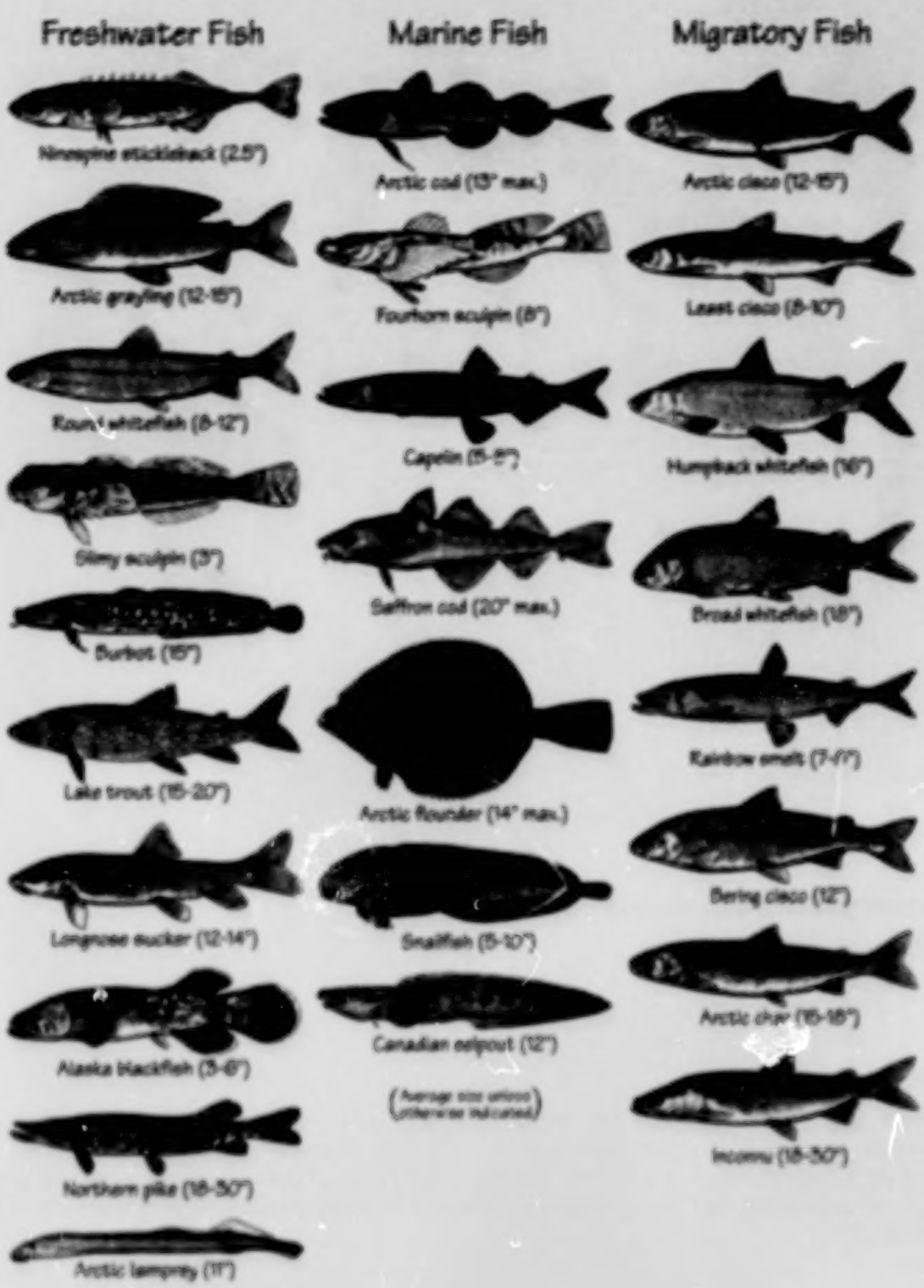
Source: North Slope Borough, 1999.

Figure III-23. Nuiqsut Changes in Subsistence Activity, 1998-1999. These results include only those households participating in the census survey and answering the question: "How much would you say your subsistence activities have changed over the past 5 years?"



Source: North Slope Borough, 1999.

Figure III-24. Nuiqsut Expenditures on Subsistence Activities, 1998-1999. Results include only those households participating in the census survey and answering the question, "...what is your best estimate of the money you spent on subsistence activities (during the past calendar year)?"



Sources: Mcphail and Lindsey (1970); Turner (1886); Morrow(1980)
Dalen (1980); Evermann and Goldsborough (1904).

Figure III-25. Representative Fish of the Arctic Environment

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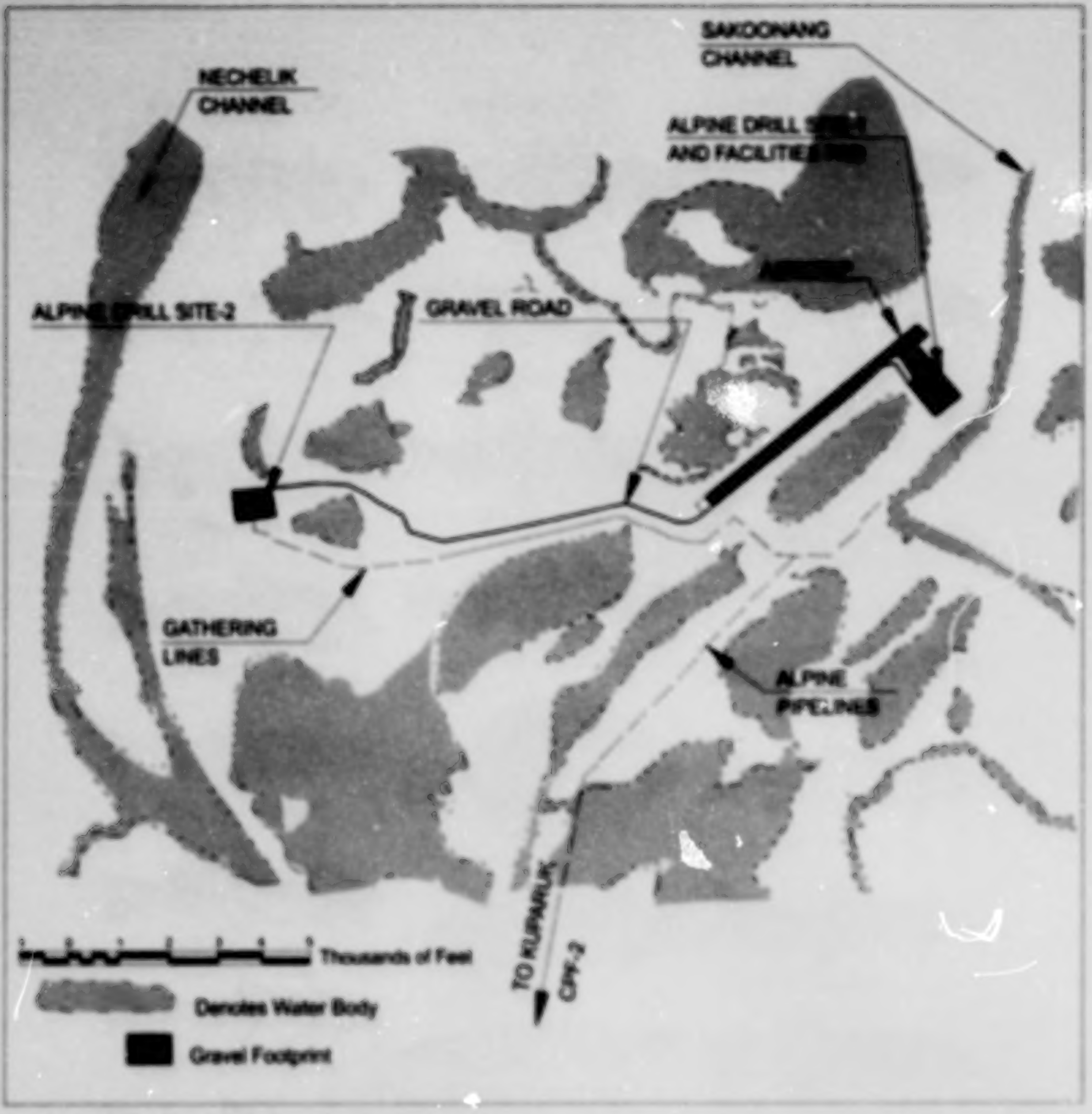


Figure IV-01 Layout of Alpine field. ConocoPhillips' new development project in the Colville River delta could serve as model for future production facilities in NPR-A. The total surface footprint covers approximately 100 acres, which is less than 1 percent of the subsurface drainage area for this 500-million-barrel field. (Figure is from Alpine Development Project: Environmental Evaluation Document, courtesty of ARCO Alaska, Inc.)

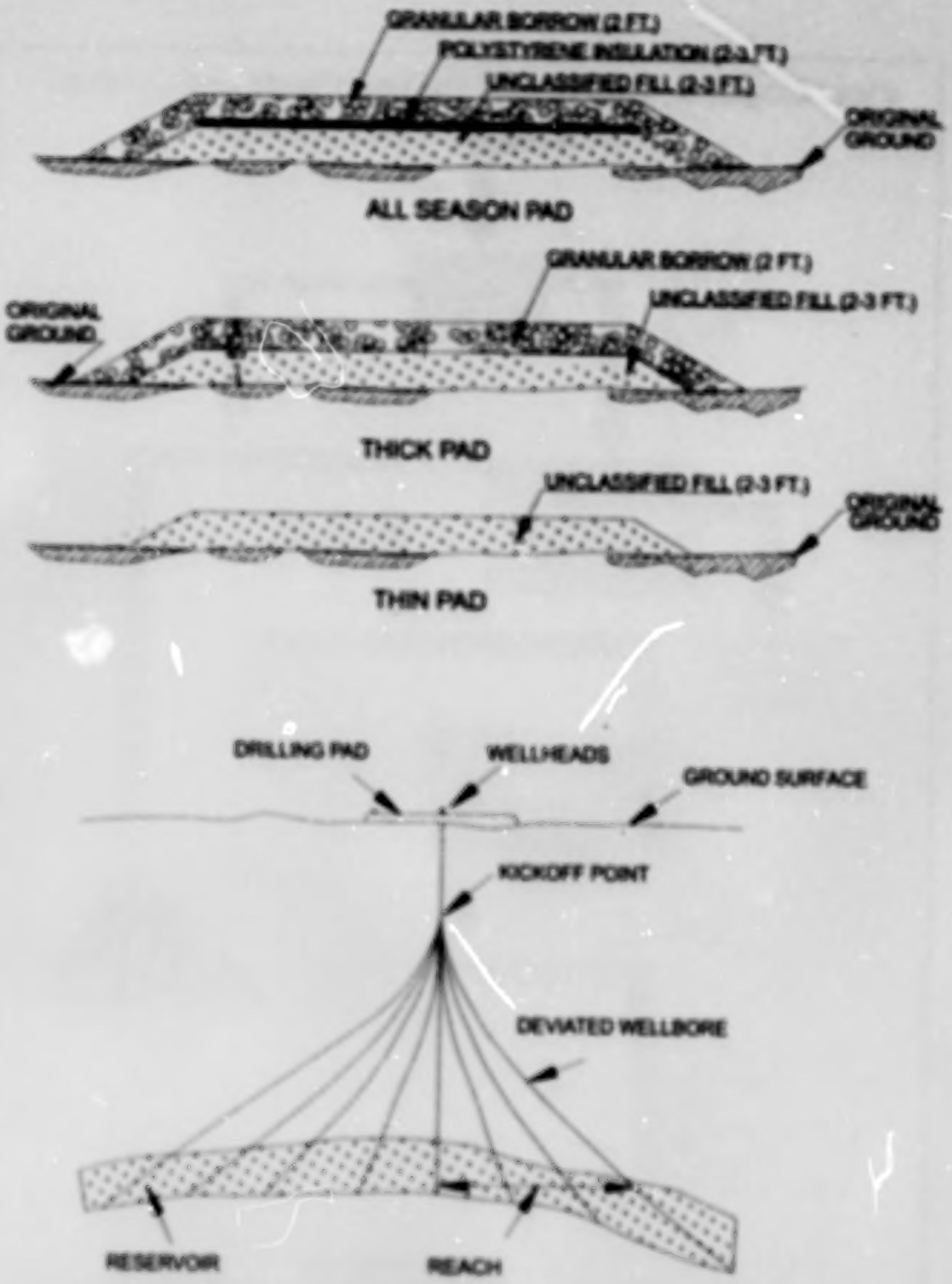
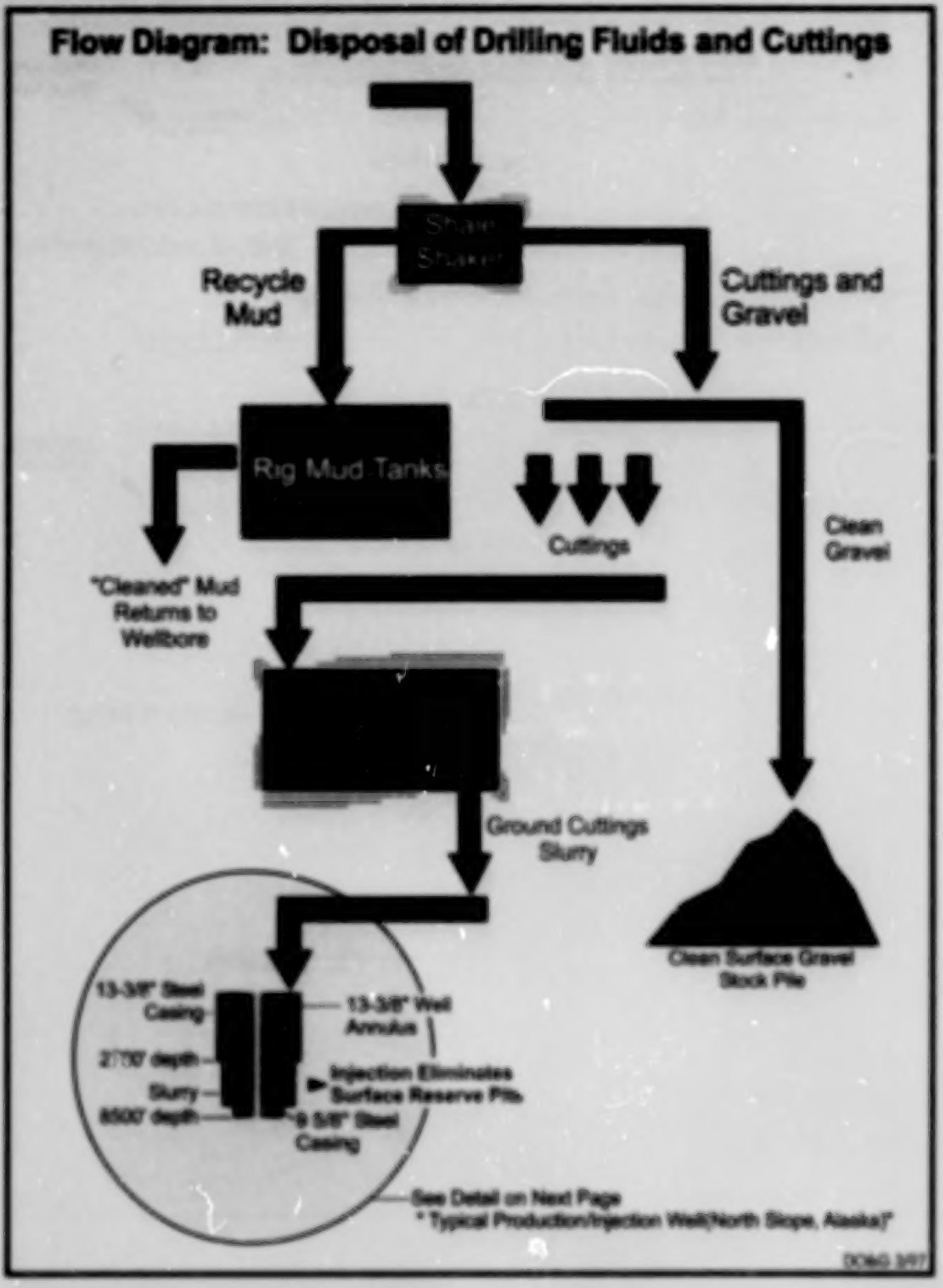


Figure IV-62. (top) Gravel Pad Construction Designs. Elevated pads are essential for all-season operations on the poorly drained tundra of NPR-A. Gravel is the preferred material because of its stability; however, known gravel sources are scarce west of the Colville River. Alternative designs using gravel as a topping material could greatly reduce gravel demands. All-season ice pads have been proposed, but not demonstrated, as a feasible alternative pad design.

(Bottom) Directional Drilling From a Surface Location. Wells deviated from vertical are standard practice in field development. Conventional wells have reach (horizontal deviation) to depth (vertical) ratios of 1:1. New technology, called *extended reach drilling*, can drill wells to reach more distant reservoir targets. Currently, the highest reach-to-depth ratio on the North Slope is 2:1 (Niakuk field, 18,098-ft reach).


Flow Diagram: Disposal of Drilling Fluids and Cuttings
Shale Shaker
Recycle Mud
Cuttings and Gravel
Rig Mud Tanks
"Cleaned" Mud Returns to Wellbore
Cuttings
Clean Gravel
Ground Cuttings Slurry
Clean Surface Gravel Stock Pile
13-3/8" Steel Casing
2700' depth
Slurry
8500' depth
13-3/8" Well Annulus
Injection Eliminates Surface Reserve Pits
9 5/8" Steel Casing
See Detail on Next Page
" Typical Production/Injection Well(North Slope, Alaska)"
DO&G 3/97

Source: State of Alaska, Dept. Of Natural Resources, 1997.

Figure IV-03. Processing Drilling Mud and Cuttings for Disposal. Current approved practices on the North Slope dispose of drilling wastes in shallow portions of production wells. Several steps are taken to recondition drilling mud and recycle rock cuttings to minimize surface disposal of these waste products.

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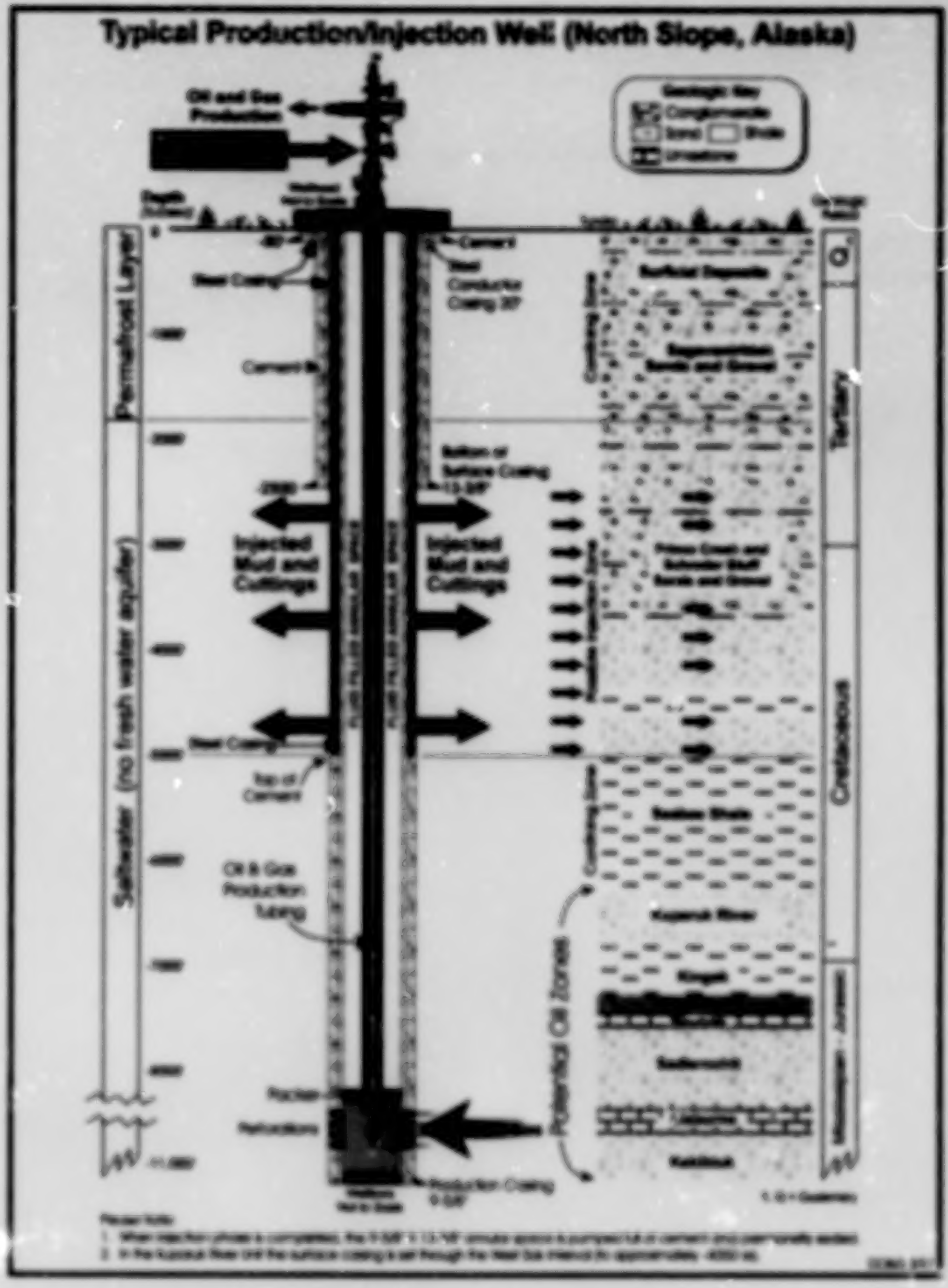

Typical Production/Injection Well (North Slope, Alaska)

Source: State of Alaska, Dept. Of Natural Resources, 1997.

Figure IV-04. Subsurface Injection of Mud and Cuttings. After processing, muds and rock cuttings are injected into the annular space of producing wells. Formations receiving the materials are 2,500-5,000 feet below the surface. When the injection phase is completed, the annular space is permanently sealed by cement.

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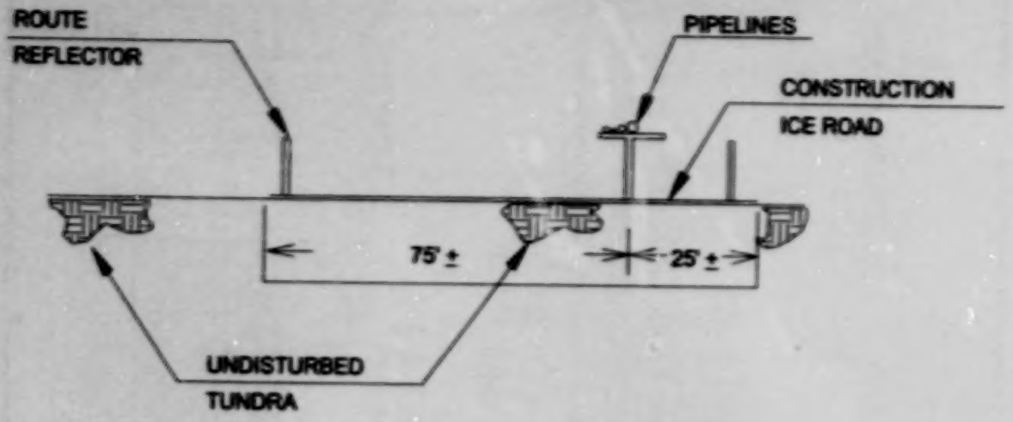
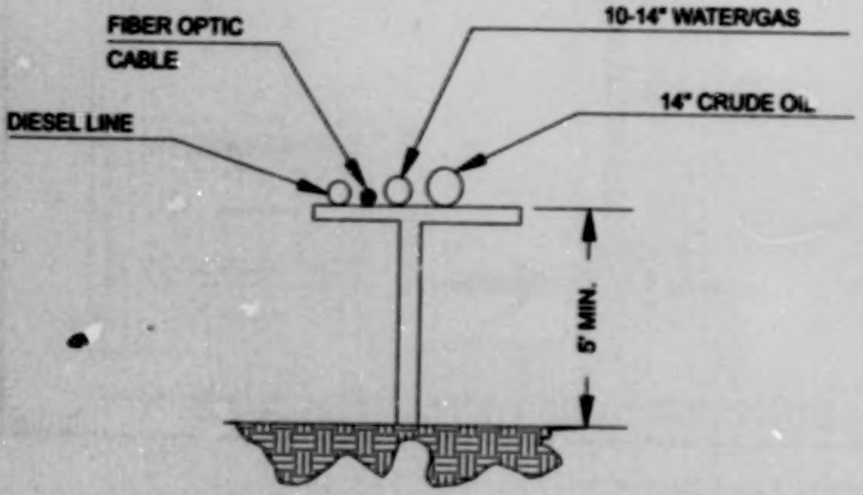
PIPELINE RIGHT-OF-WAY



ALPINE PIPELINES WITH TYPICAL VSM SECTION



Source: Alpine Project description, courtesy of ARCO Alaska, Inc.

Figure IV-05. Typical Pipeline Construction. Future pipelines in NPR-A are likely to be elevated on Vertical Support Members (VSM). A minimum height of 5 ft is maintained to minimize wildlife disturbance. Pipelines are installed during winter using ice roads, and there will be no permanent gravel road paralleling pipeline corridors.

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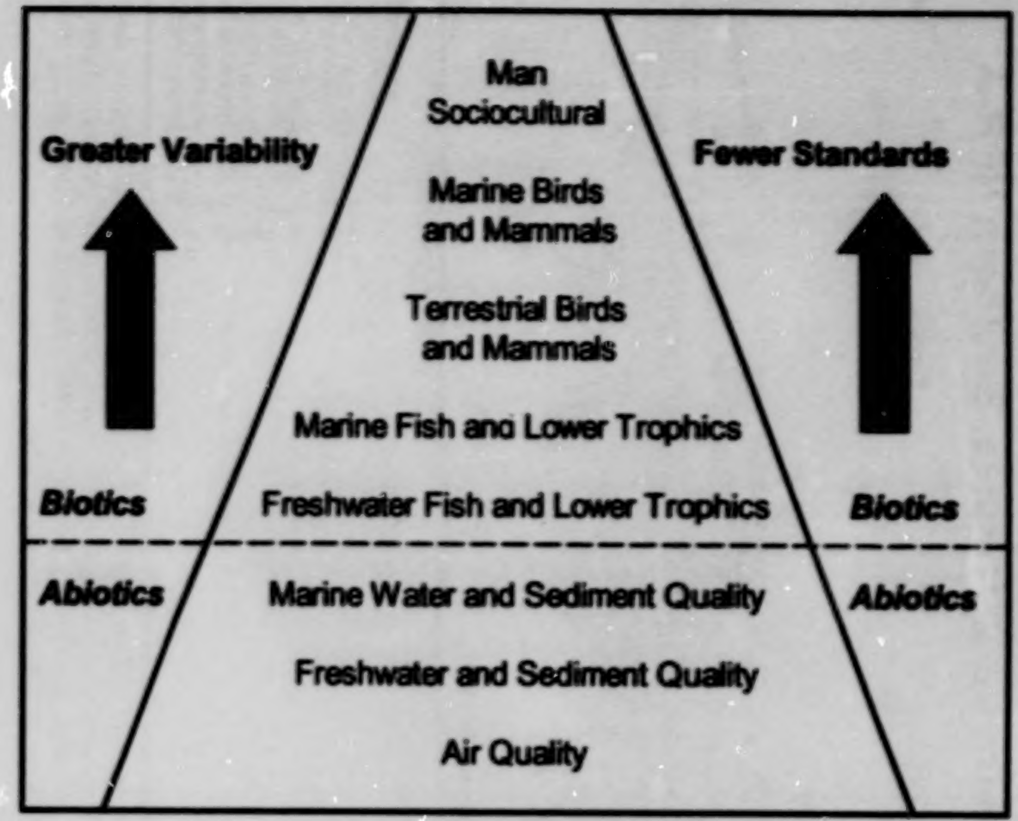
Man
Sociocultural
Greater Variability
Fewer Standards
Marine Birds and Mammals
Terrestrial Birds and Mammals
Marine Fish and Lower Trophics
Biotics
Freshwater Fish and Lower Trophics
Biotics
Abiotics
Marine Water and Sediment Quality
Abiotics
Freshwater and Sediment Quality
Air Quality

Figure IV-06. Relationship Among Resources, Standards, and Degree of Variability.

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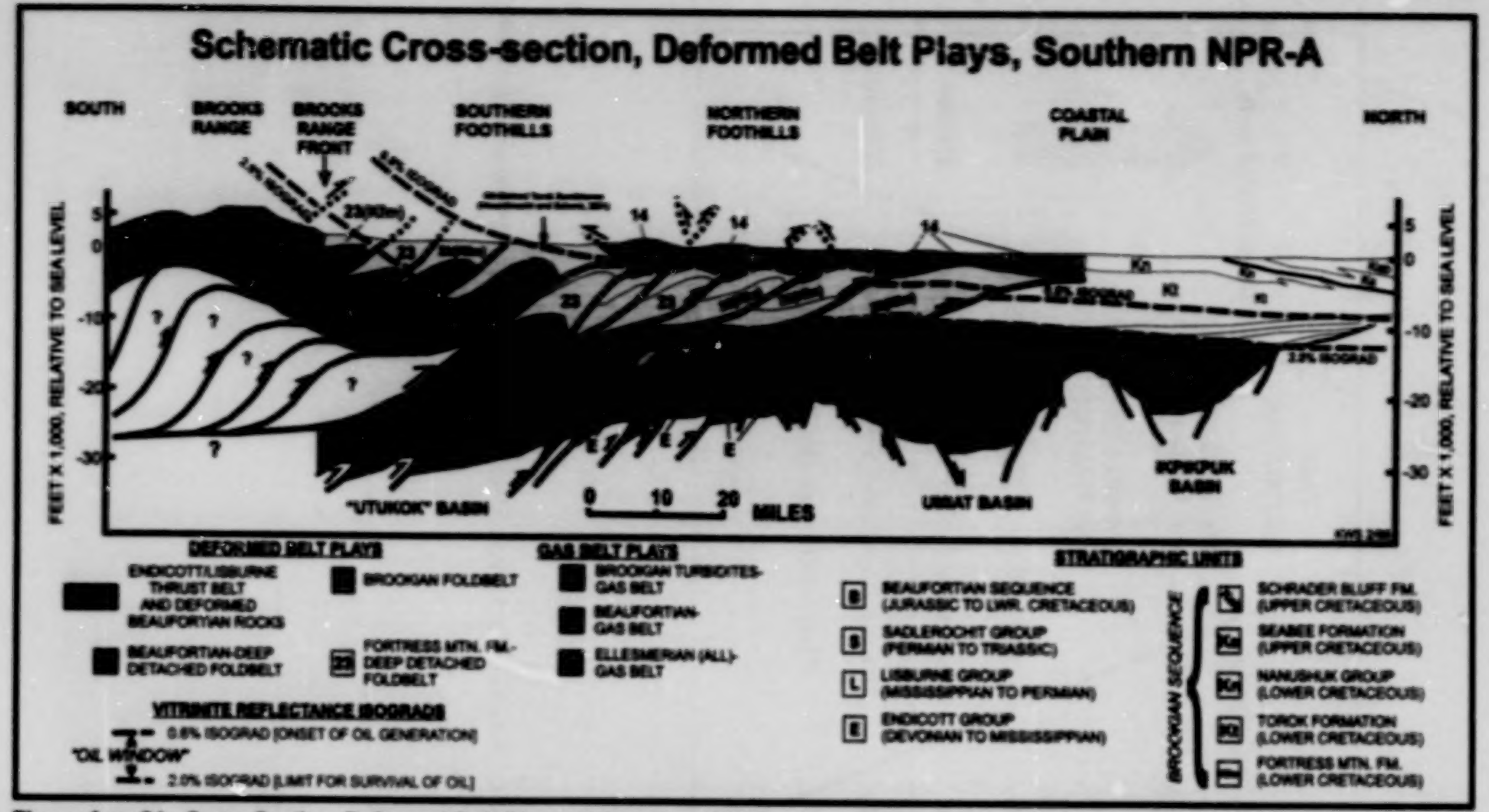
Schematic Cross-section, Deformed Belt Plays, Southern NPR-A
SOUTH
BROOKS RANGE
BROOKS RANGE FRONT
SOUTHERN FOOTHILLS
NORTHERN FOOTHILLS
COASTAL PLAIN
NORTH
FEET X 1,000, RELATIVE TO SEA LEVEL
5
0
-10
-20
-30
23(Kfm)
23
14
Kn
Kt
?
E
"UTUKOK" BASIN
0 10 20 MILES
UMIAT BASIN
IKPIKPUK BASIN
2.0% ISOGRAD
DEFORMED BELT PLAYS
ENDICOTT/LISBURNE THRUST BELT AND DEFORMED BEAUFORTIAN ROCKS
BROOKIAN FOLDBELT
BEAUFORTIAN-DEEP DETACHED FOLDBELT
FORTRESS MTN. FM.-DEEP DETACHED FOLDBELT
GAS BELT PLAYS
BROOKIAN TURBIDITES-GAS BELT
BEAUFORTIAN-GAS BELT
ELLESMERIAN (ALL)-GAS BELT
VITRINITE REFLECTANCE ISOGRADS
0.6% ISOGRAD [ONSET OF OIL GENERATION]
"OIL WINDOW"
2.0% ISOGRAD [LIMIT FOR SURVIVAL OF OIL]
STRATIGRAPHIC UNITS
B BEAUFORTIAN SEQUENCE (JURASSIC TO LWR. CRETACEOUS)
S SADLEROCHIT GROUP (PERMIAN TO TRIASSIC)
L LISBURNE GROUP (MISSISSIPPIAN TO PERMIAN)
E ENDICOTT GROUP (DEVONIAN TO MISSISSIPPIAN)
BROOKIAN SEQUENCE
SCHRADER BLUFF FM. (UPPER CRETACEOUS)
SEABEE FORMATION (UPPER CRETACEOUS)
NANUSHUK GROUP (LOWER CRETACEOUS)
TOROK FORMATION (LOWER CRETACEOUS)
FORTRESS MTN. FM. (LOWER CRETACEOUS)

Figure App-01. Cross Section, Deformed Belt Plays of Southern NPR-A. Cross section showing architecture of plays involving deformed rocks of the Brooks Range and the southern and northern foothills belts. Elements schematized from Mayfield, Tailleur, and Ellersieck (1988, pl. 8.2), Moore et al. (1992, pl. 1, B-B'), Kelly (1988, 1990), Kelley and Brosge' (1995, fig. 4, A-A'), Mull et al. (1987), Cole et al. (1997, pl. 2), and Wallace, Moore, and Plafker (1997, fig. 6), with speculative interpretations of seismic data by author.

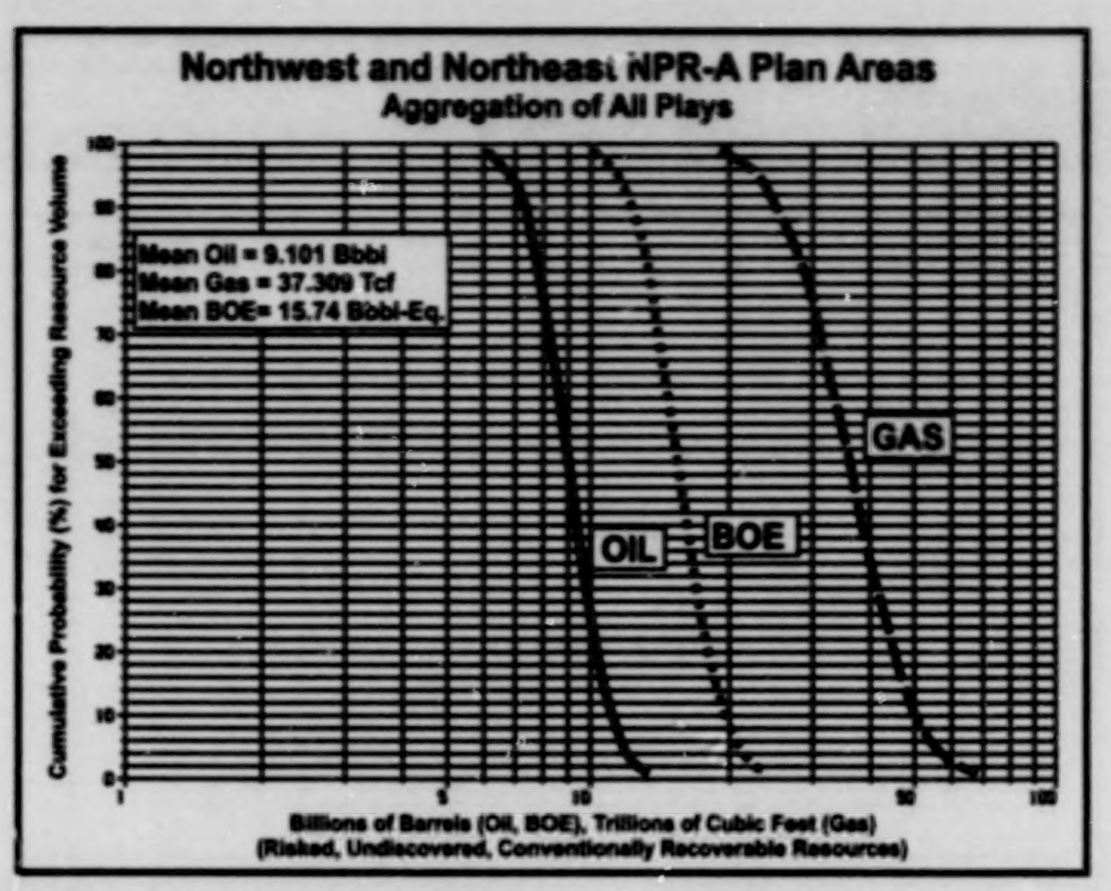

Figure App-02. Cumulative Probability Plot for Conventionally Recoverable Oil and Gas in the Northwest and Northeast NPR-A Planning Areas. Aggregated oil and gas resources are represented as BOE or equivalent barrels of oil (5,620 cubic feet of gas equivalent to 1 barrel of oil). Because of uncertainty, input variables are entered as ranged probability distributions and overall resources are consequently calculated as probability distributions. It is highly probable that small volumes of resources are present but improbable that the maximum possible resource volumes are achieved within the assessment area.

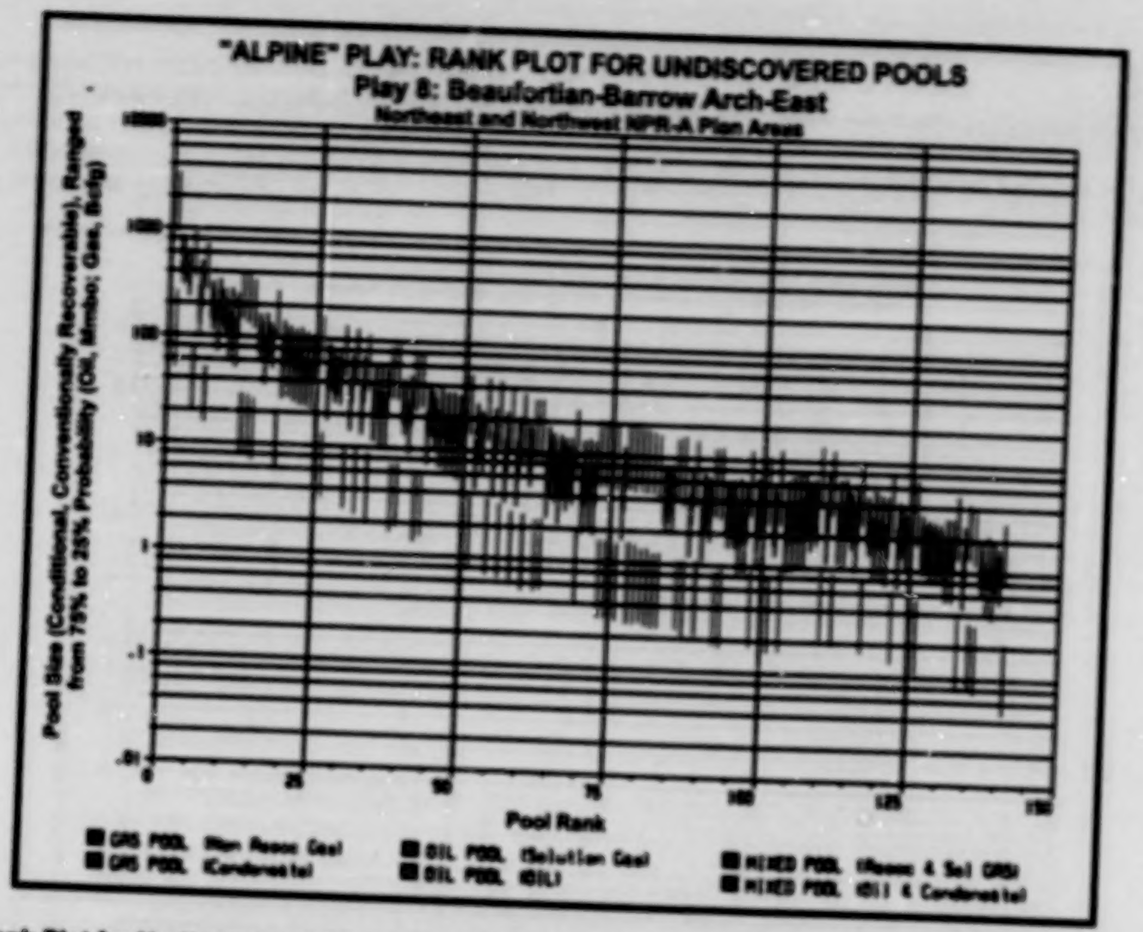

Figure App-03. Size-Rank Plot for Undiscovered Oil and Gas Pools. Modeled for the Alpine-equivalent play (8. Beaufortian-Barrow Arch-East). Each pair of vertical bars represents oil and gas resources in a single hypothetical pool and the lengths of the bars show the range of possible resources between the 75% and 25% probabilities. Play may contain up to 141 pools. The rank-1 pool is a gas pool with a mean gas resource of 2,861 Bcf. With a mean oil resource of 634 Mmbo, the rank-2 pool is the largest oil pool, and possibly as large as 1,611 Mmbo at a 5% probability.

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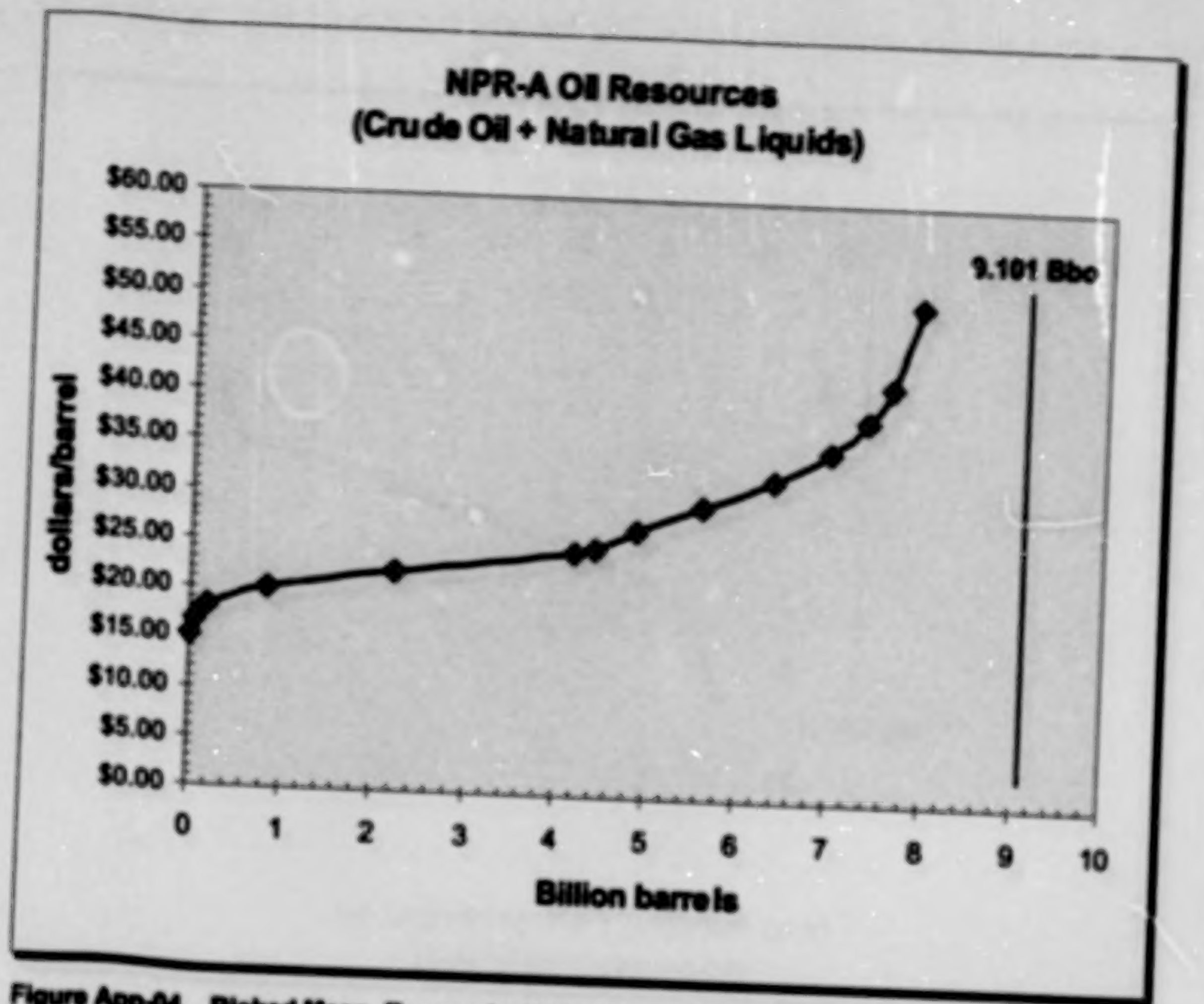

Figure App-04. Risked Mean, Economically Recoverable Oil Volumes Relative to Market Price

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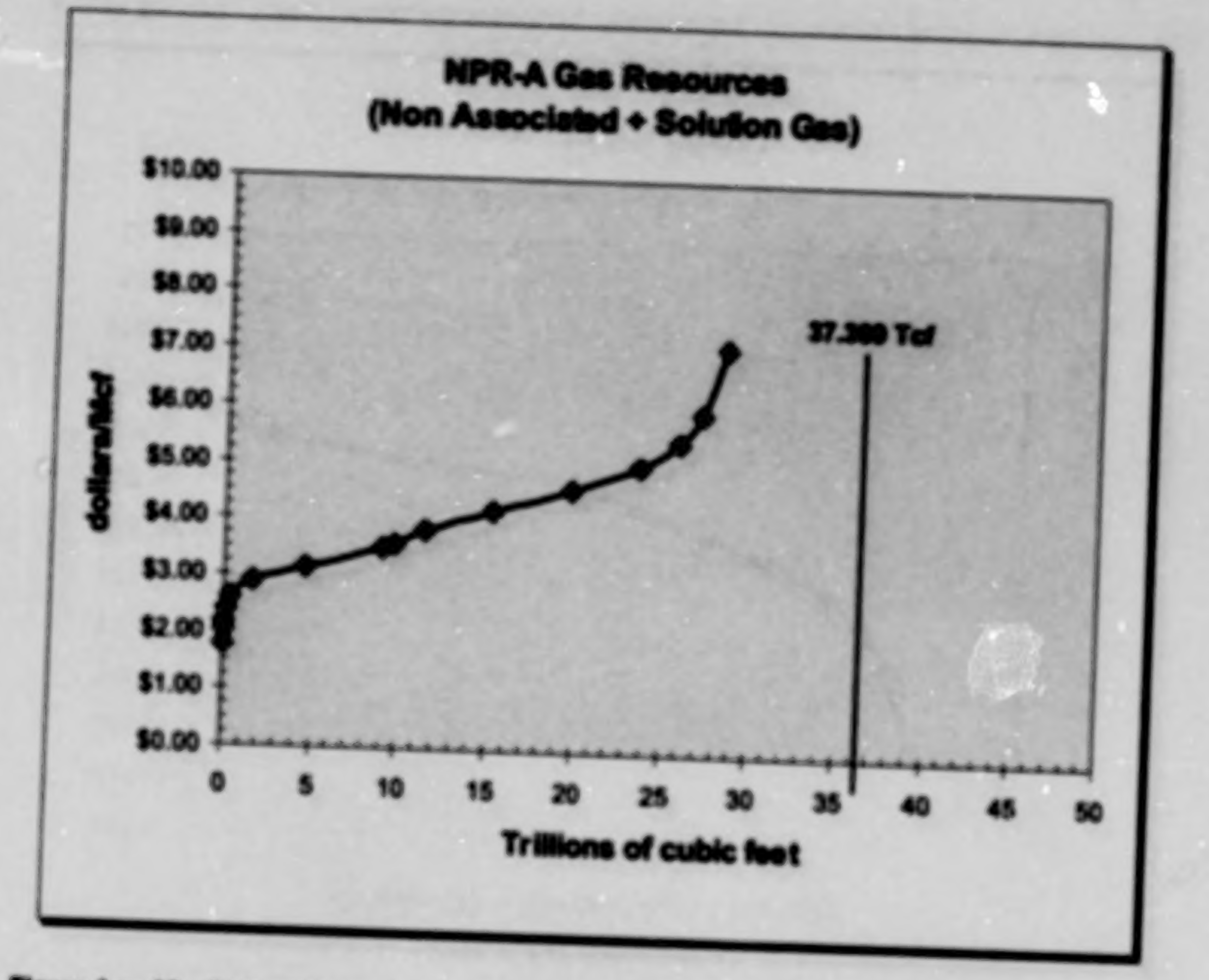

Figure App-05. Risked Mean, Economically Recoverable Gas Volumes Relative to Market Price

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Oil and gas activities
Description: IV-44

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Description (scenarios): IV-72, Appendix 9
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Key issues and management decisions: II-6
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  summary: Appendix 2-1
  effects of the alternatives: IV-83, IV-129, IV-286, IV-347, V-17
  unavoidable effects: IV-504
  short and long term effects: IV-511
  irreversible effects: IV-517
  effects of a low probability, very large spill from a well blowout: IV-526
  effects of possible but unlikely permanent roads: IV-543
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Key issues and management decisions: II-7
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  unavoidable effects: IV-509
  short and long term effects: IV-516
  irreversible effects: IV-521
  effects of a low probability, very large spill from a well blowout: IV-539
  effects of possible but unlikely permanent roads: IV-555
  cumulative effects: IV-497
See also Visual Resources.
See also Wilderness.

Response to comments on the drat EIS
Section VII of the EIS is devoted to comments on the draft EIS and responses to the comments.

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Sales
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See Scenarios.

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  summary: Appendix 2-23
  effects of the alternatives: IV-114, IV-247, IV-331, IV-386, V-140
  unavoidable effects: IV-509
  short and long term effects: IV-515
  irreversible effects: IV-520
  effects of a low probability, very large spill from a well blowout: IV-534
  effects of possible but unlikely permanent roads: IV-554
  cumulative effects: IV-487

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  effects of the alternatives: IV-82, IV-125, IV-284, IV-346, V-13
  unavoidable effects: IV-504
  short and long term effects: IV-511
  irreversible effects: IV-517
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Definitions: II-15.
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Effectiveness: Appendix 12

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Key issues and management decisions: II-7
Description: III-96
Effects
  summary: Appendix 2-22
  effects of the alternatives: IV-112, IV-225, IV-326, IV-384, V-123
  unavoidable effects: IV-508
  short and long term effects: IV-515
  irreversible effects: IV-520
  effects of a low probability, very large spill from a well blowout: IV-537
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Traditional knowledge
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Description: III-168
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Key issues and management decisions: II-5
Description: III-45
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  effects of the alternatives: IV-90, IV-158, IV-297, IV-297, V-47
  unavoidable effects: IV-505
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Key issues and management decisions: II-9
Description: III-162
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  summary: Appendix 2-29
  effects of the alternatives: IV-122, IV-278, IV-341, IV-341, V-167
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  effects of a low probability, very large spill from a well blowout: IV-539
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Wainwright
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Key issues and management decisions: II-5
Description: III-33
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  unavoidable effects: IV-504
  short and long term effects: IV-511
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  effects of a low probability, very large spill from a well blowout: IV-526
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Description: III-45
Overview of Effects

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  summary: Appendix 2-28
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  short and long term effects: IV-516
  irreversible effects: IV-521
  effects of a low probability, very large spill from a well blowout: IV-539
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Description: III-157
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See also Visual Resources.

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See Marine Mammals for beluga and gray whales.

Wildlife Habitat Alternative
Audubon's Wildlife Habitat Alternative: II-26

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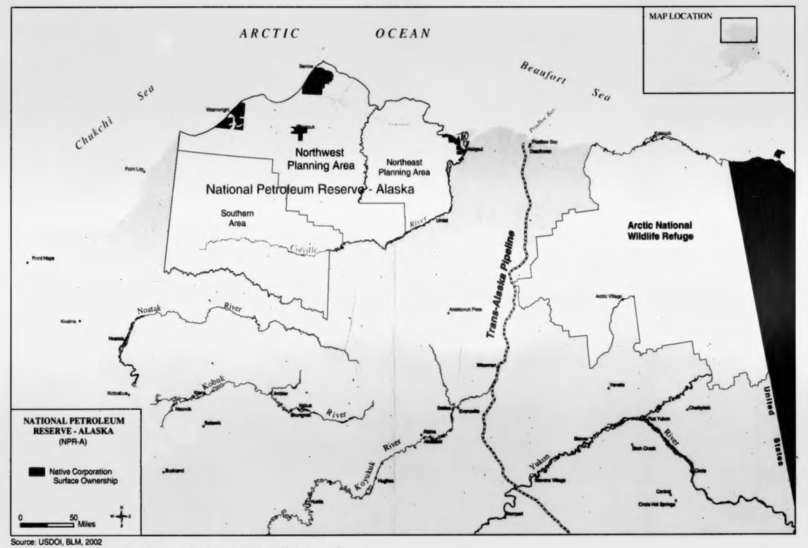

Source: USDOI, BLM, 2002

Map 01. National Petroleum Reserve-Alaska (NPR-A) and the North Slope

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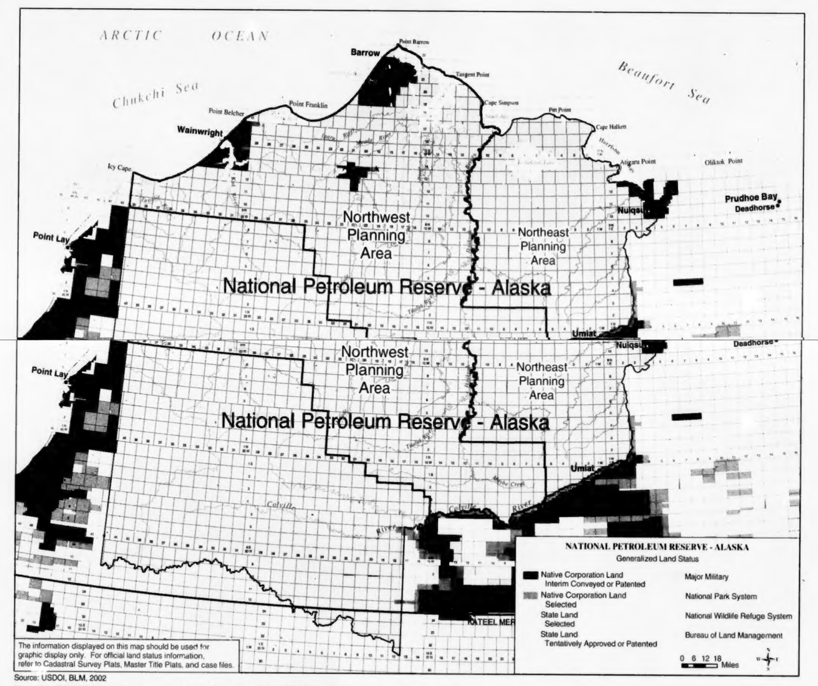

The information displayed on this map should be used for graphic display only. For official land status information, refer to Cadastral Survey Plats, Master Title Plats, and case files.

Source: USDOI, BLM, 2002

Map 02. NW NPR-A and Generalized Land Status within NPR-A (as of September 2002)

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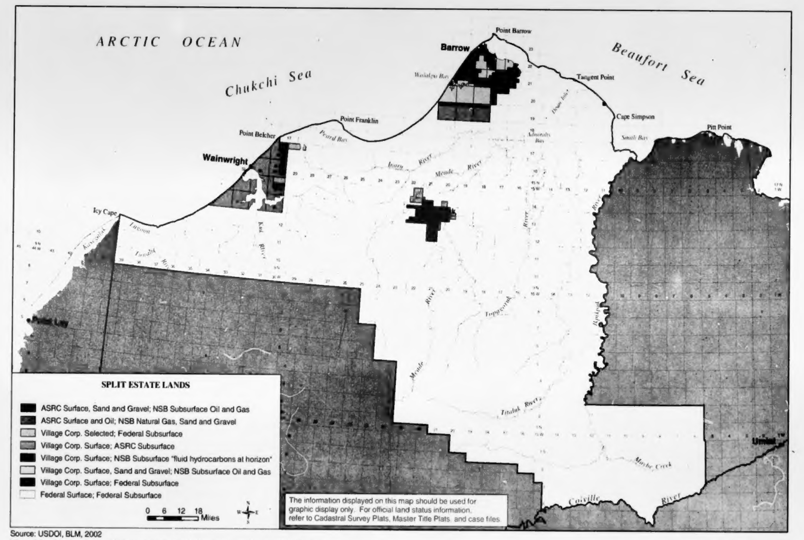

SPLIT ESTATE LANDS

- ■ ASRC Surface, Sand and Gravel; NSB Subsurface Oil and Gas
- ■ ASRC Surface and Oil; NSB Natural Gas, Sand and Gravel
- ▨ Village Corp. Selected; Federal Subsurface
- ▨ Village Corp. Surface; ASRC Subsurface
- ■ Village Corp. Surface; NSB Subsurface "fluid hydrocarbons at horizon"
- ☐ Village Corp. Surface, Sand and Gravel; NSB Subsurface Oil and Gas
- ■ Village Corp. Surface; Federal Subsurface
- ☐ Federal Surface; Federal Subsurface

The information displayed on this map should be used for graphic display only. For official land status information, refer to Cadastral Survey Plats, Master Title Plats, and case files.

Source: USDOI, BLM, 2002

Map 05. Surface and Subsurface Split Estate Lands in NW NPR-A

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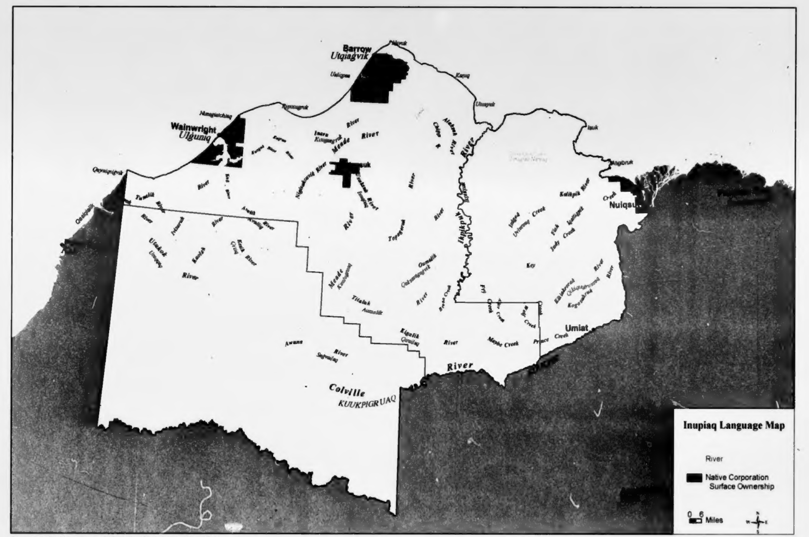

Source: North Slope Borough Planning Department, May 1997

Map 06. Communities, Rivers, and Coastal Locations within NPR-A (Inupiaq Translation)

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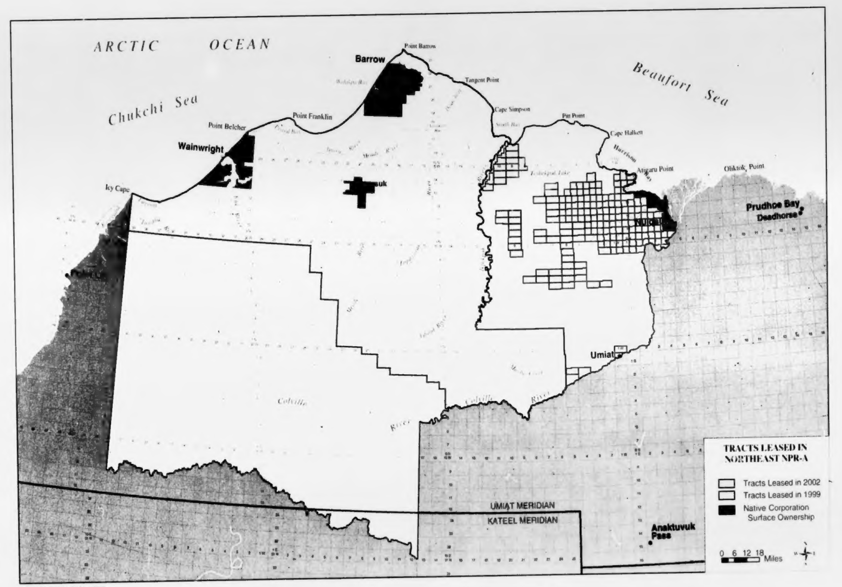

Source: USDOI, BLM, 2002

Map 09. Northeast NPR-A 1999 and 2002 Oil and Gas Leased Tracts

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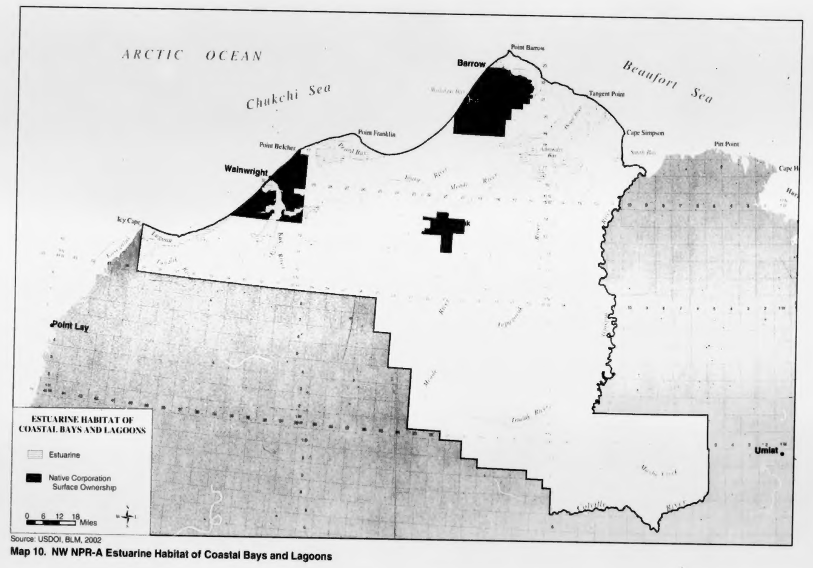

Source: USDOI, BLM, 2002

Map 10. NW NPR-A Estuarine Habitat of Coastal Bays and Lagoons

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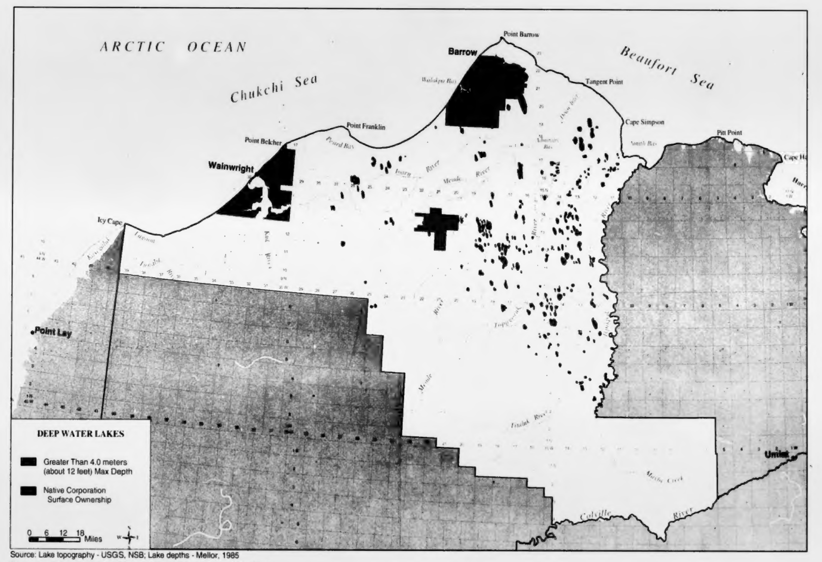

Source: Lake topography - USGS, NSB; Lake depths - Mellor, 1985

Map 11. Locations of Deep Water Lakes in NW NPR-A

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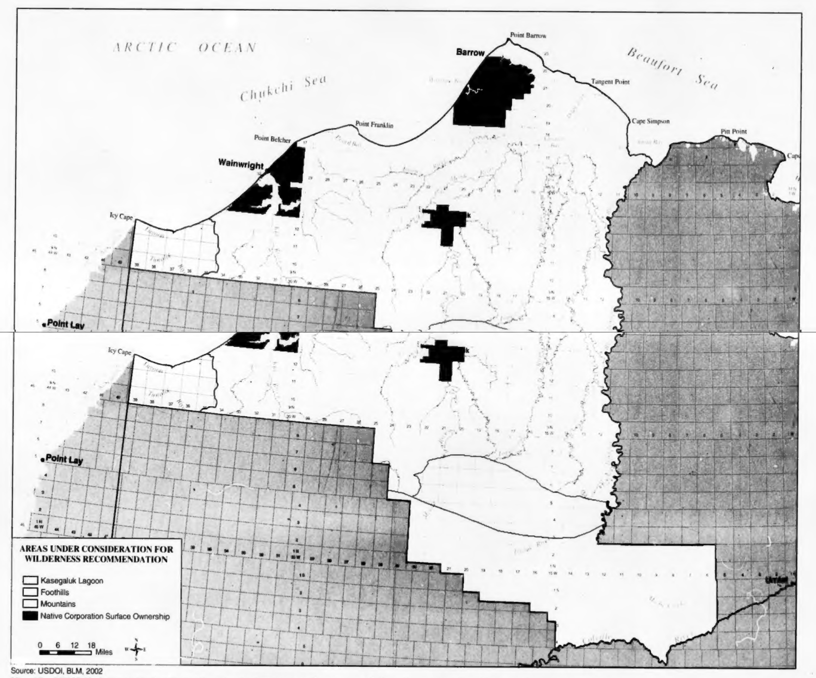

Source: USDOI, BLM, 2002

Map 12. NW NPR-A Areas Under Consideration for Wilderness Recommendation: Mountains, Foothills, and Kasegaluk Lagoon

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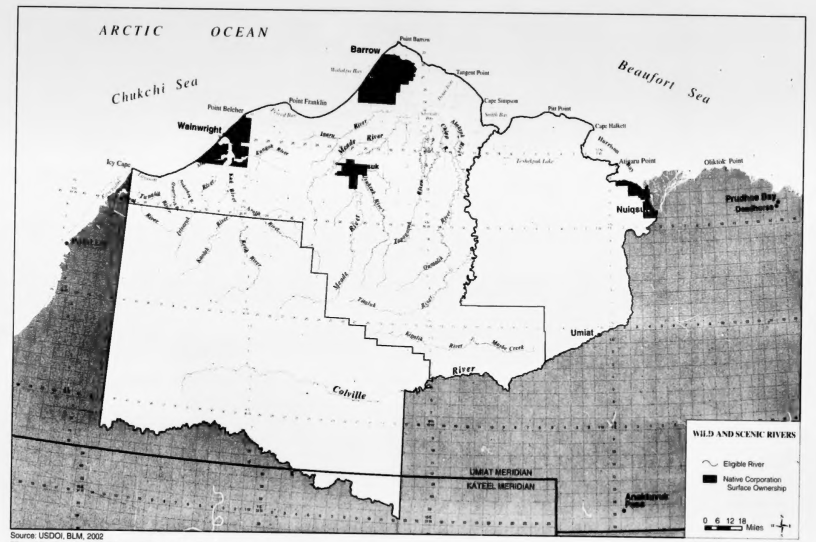

Source: USDOI, BLM, 2002

Map 13. NW NPR-A Rivers Eligible for Designation as Wild and Scenic

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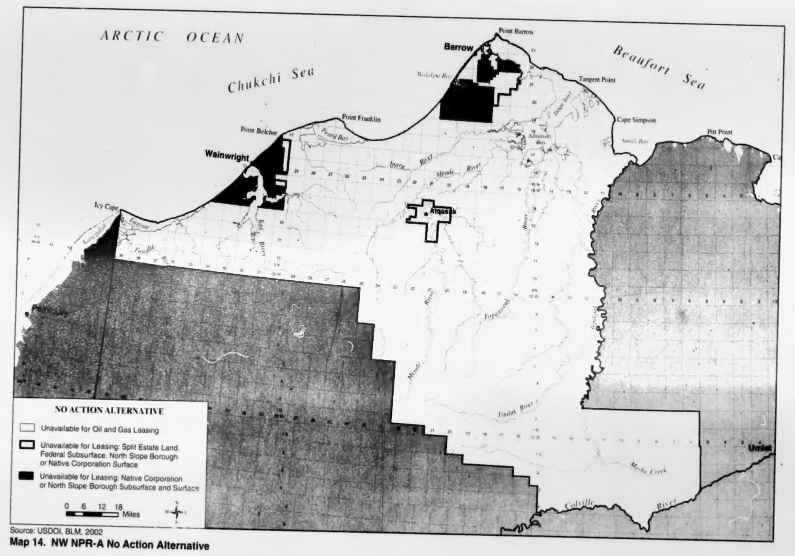

Source: USDOI, BLM, 2002

Map 14. NW NPR-A No Action Alternative

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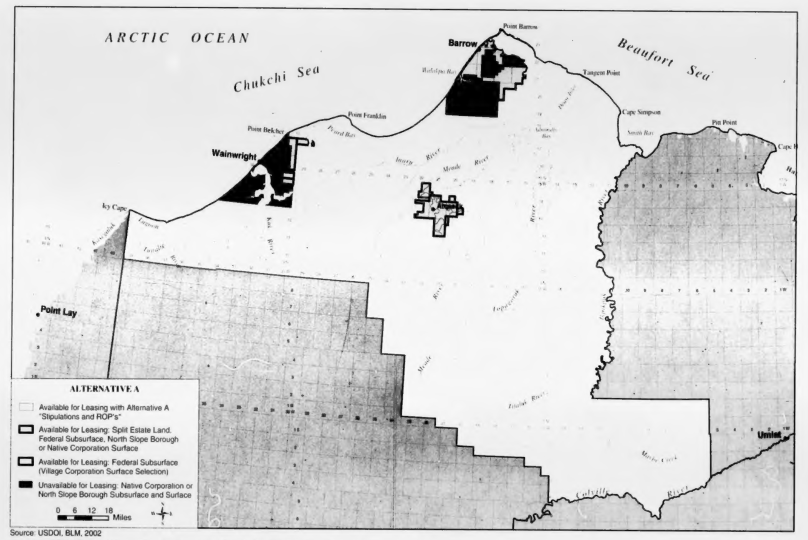
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Tangent Point
Cape Simpson
Pitt Point
Point Franklin
Point Belcher
Wainwright
Icy Cape
Atqasuk
Point Lay
Umiat
Colville River
ALTERNATIVE A
Available for Leasing with Alternative A "Stipulations and ROP's"
Available for Leasing: Split Estate Land, Federal Subsurface, North Slope Borough or Native Corporation Surface
Available for Leasing: Federal Subsurface (Village Corporation Surface Selection)
Unavailable for Leasing: Native Corporation or North Slope Borough Subsurface and Surface
0 6 12 18 Miles

Source: USDOI, BLM, 2002

Map 15. NW NPR-A Alternative A: Areas Available for Oil and Gas Leasing

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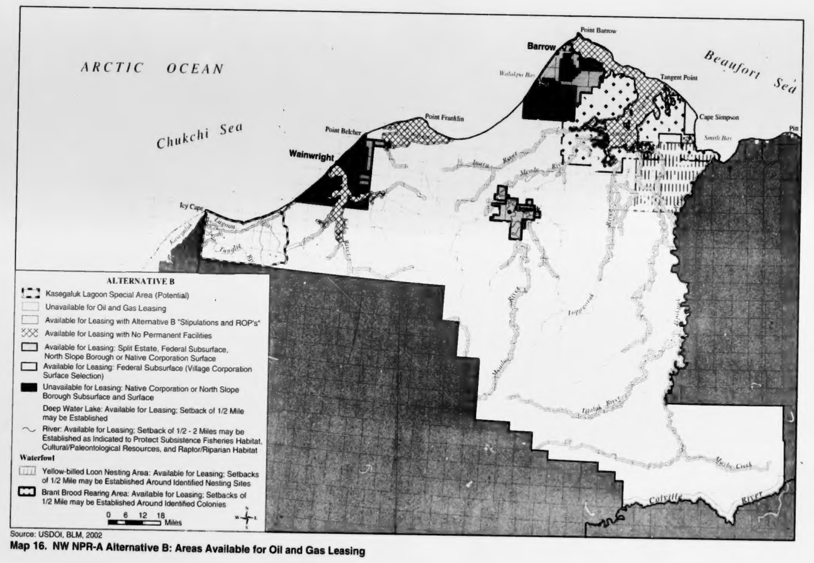
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Walakpa Bay
Tangent Point
Cape Simpson
Smith Bay
Pitt
Point Franklin
Point Belcher
Wainwright
Icy Cape
Kasegaluk
Lagoon
Tunalik River
Inaru River
Meade River
Topagoruk
Ikpikpuk
Titaluk River
Maybe Creek
Colville River
ALTERNATIVE B
Kasegaluk Lagoon Special Area (Potential)
Unavailable for Oil and Gas Leasing
Available for Leasing with Alternative B "Stipulations and ROP's"
Available for Leasing with No Permanent Facilities
Available for Leasing: Split Estate, Federal Subsurface, North Slope Borough or Native Corporation Surface
Available for Leasing: Federal Subsurface (Village Corporation Surface Selection)
Unavailable for Leasing: Native Corporation or North Slope Borough Subsurface and Surface
Deep Water Lake: Available for Leasing; Setback of 1/2 Mile may be Established
River: Available for Leasing; Setback of 1/2 - 2 Miles may be Established as Indicated to Protect Subsistence Fisheries Habitat, Cultural/Paleontological Resources, and Raptor/Riparian Habitat
Waterfowl
Yellow-billed Loon Nesting Area: Available for Leasing; Setbacks of 1/2 Mile may be Established Around Identified Nesting Sites
Brant Brood Rearing Area: Available for Leasing; Setbacks of 1/2 Mile may be Established Around Identified Colonies
0 6 12 18
Miles
N
W
E
S

Source: USDOI, BLM, 2002

Map 16. NW NPR-A Alternative B: Areas Available for Oil and Gas Leasing

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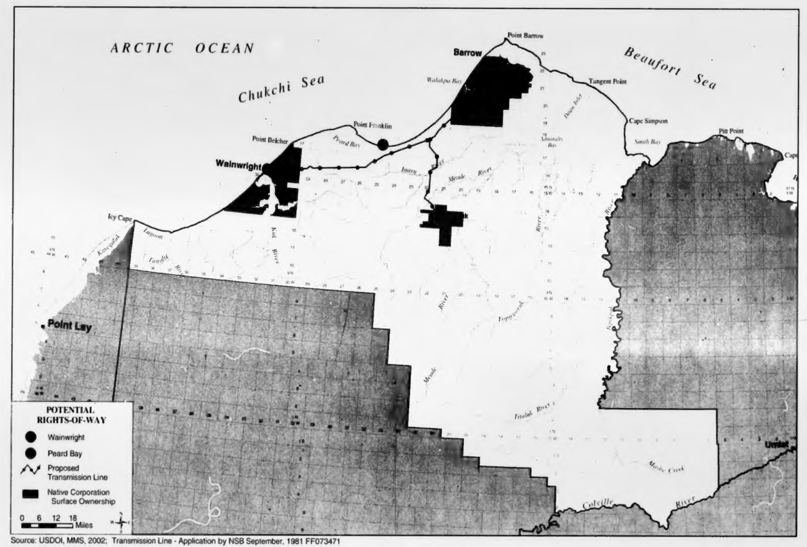

Source: USDOI, MMS, 2002; Transmission Line - Application by NSB September, 1981 FF073471

Map 17. NW NPR-A Potential Right-of-Way Sites

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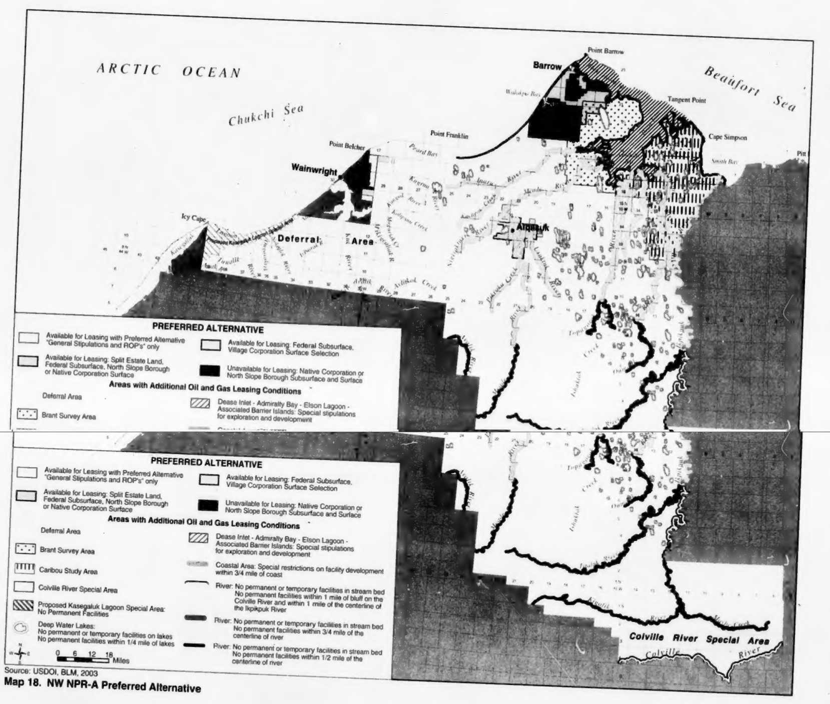
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Tangent Point
Cape Simpson
Point Franklin
Peard Bay
Point Belcher
Wainwright
Icy Cape
Deferral Area
Atqasuk
Colville River Special Area
Colville River
PREFERRED ALTERNATIVE
Available for Leasing with Preferred Alternative "General Stipulations and ROP's" only
Available for Leasing: Federal Subsurface, Village Corporation Surface Selection
Available for Leasing: Split Estate Land, Federal Subsurface, North Slope Borough or Native Corporation Surface
Unavailable for Leasing: Native Corporation or North Slope Borough Subsurface and Surface
Areas with Additional Oil and Gas Leasing Conditions
Deferral Area
Dease Inlet - Admiralty Bay - Elson Lagoon - Associated Barrier Islands: Special stipulations for exploration and development
Brant Survey Area
Coastal Area: Special restrictions on facility development within 3/4 mile of coast
Caribou Study Area
Colville River Special Area
River: No permanent or temporary facilities in stream bed No permanent facilities within 1 mile of bluff on the Colville River and within 1 mile of the centerline of the Ikpikpuk River
Proposed Kasegaluk Lagoon Special Area: No Permanent Facilities
River: No permanent or temporary facilities in stream bed No permanent facilities within 3/4 mile of the centerline of river
Deep Water Lakes: No permanent or temporary facilities on lakes No permanent facilities within 1/4 mile of lakes
River: No permanent or temporary facilities in stream bed No permanent facilities within 1/2 mile of the centerline of river
0 6 12 18 Miles

Source: USDOI, BLM, 2003

Map 18. NW NPR-A Preferred Alternative

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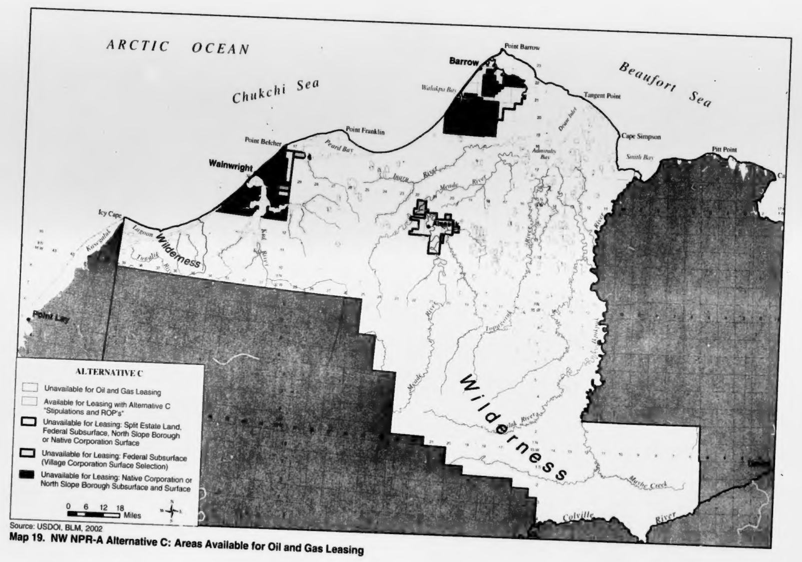

ALTERNATIVE C

- ☐ Unavailable for Oil and Gas Leasing
- ☐ Available for Leasing with Alternative C "Stipulations and ROP's"
- ☐ Unavailable for Leasing: Split Estate Land, Federal Subsurface, North Slope Borough or Native Corporation Surface
- ☐ Unavailable for Leasing: Federal Subsurface (Village Corporation Surface Selection)
- ■ Unavailable for Leasing: Native Corporation or North Slope Borough Subsurface and Surface

0 6 12 18 Miles

Source: USDOI, BLM, 2002

Map 19. NW NPR-A Alternative C: Areas Available for Oil and Gas Leasing

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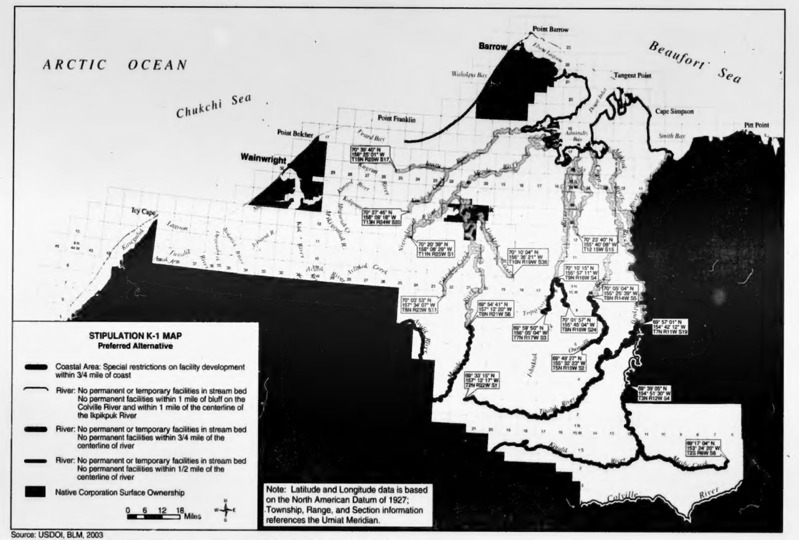
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Tangent Point
Cape Simpson
Smith Bay
Pitt Point
Admiralty Bay
Dease Inlet
Point Franklin
Peard Bay
Point Belcher
Wainwright
Icy Cape
Colville River
STIPULATION K-1 MAP
Preferred Alternative
Coastal Area: Special restrictions on facility development within 3/4 mile of coast
River: No permanent or temporary facilities in stream bed No permanent facilities within 1 mile of bluff on the Colville River and within 1 mile of the centerline of the Ikpikpuk River
River: No permanent or temporary facilities in stream bed No permanent facilities within 3/4 mile of the centerline of river
River: No permanent or temporary facilities in stream bed No permanent facilities within 1/2 mile of the centerline of river
Native Corporation Surface Ownership
0 6 12 18 Miles
Note: Latitude and Longitude data is based on the North American Datum of 1927; Township, Range, and Section information references the Umiat Meridian.

Source: USDOI, BLM, 2003

Map 20. NW NPR-A Preferred Alternative/Stipulation K-1: River Setback Transition Locations

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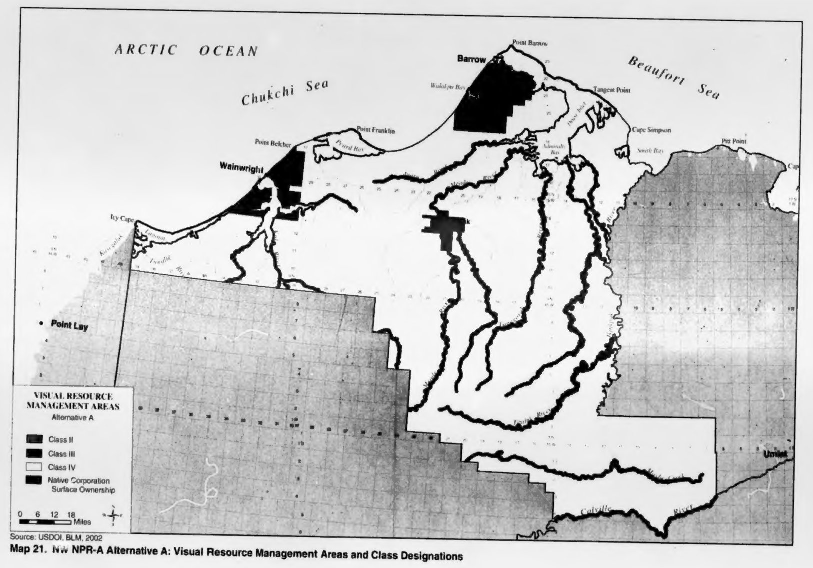
MAP 17



Source: USDOI, BLM, 2002

Map 21. NW NPR-A Alternative A: Visual Resource Management Areas and Class Designations

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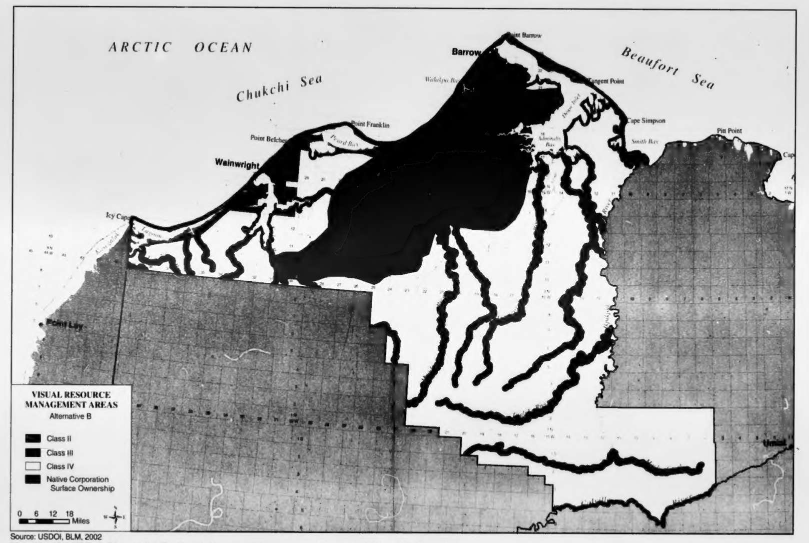

Source: USDOI, BLM, 2002

Map 22. NW NPR-A Alternative B: Visual Resource Management Areas and Class Designations

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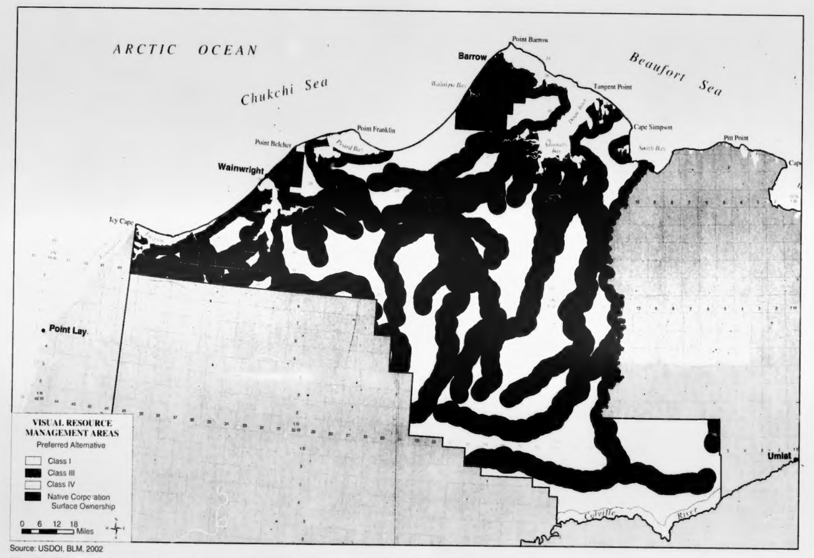
MAP 19



Source: USDOI, BLM, 2002

Map 23. NW NPR-A Preferred Alternative Visual Resource Management Areas and Class Designations

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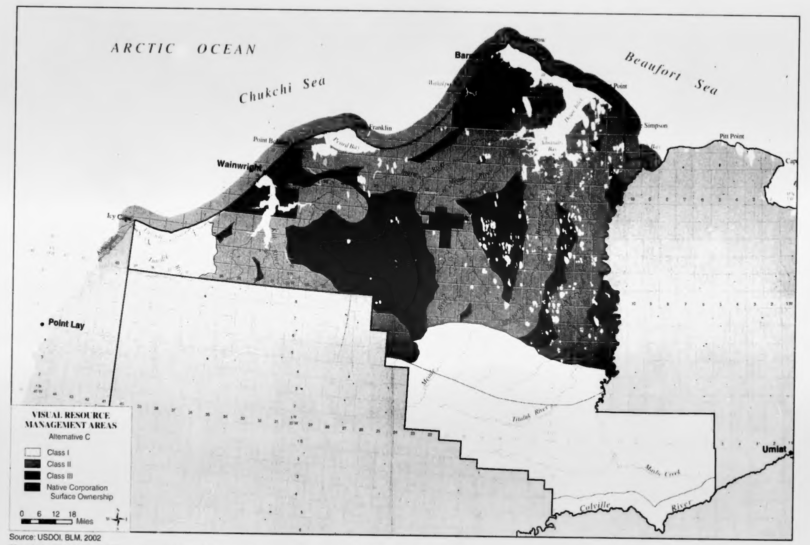
MAP 20



Source: USDOI, BLM, 2002

Map 24. NW NPR-A Alternative C: Visual Resource Management Areas and Class Designations

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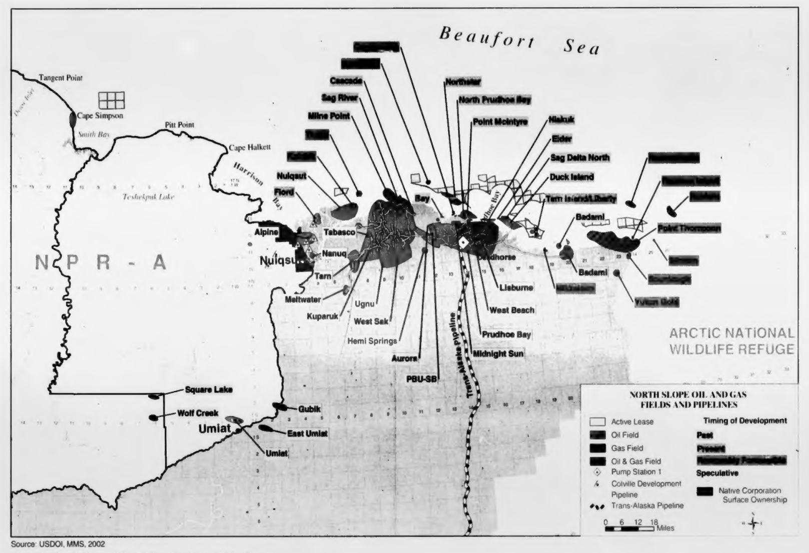
MAP 21



Source: USDOI, MMS, 2002

Map 25. North Slope Oil and Gas Fields and Pipelines

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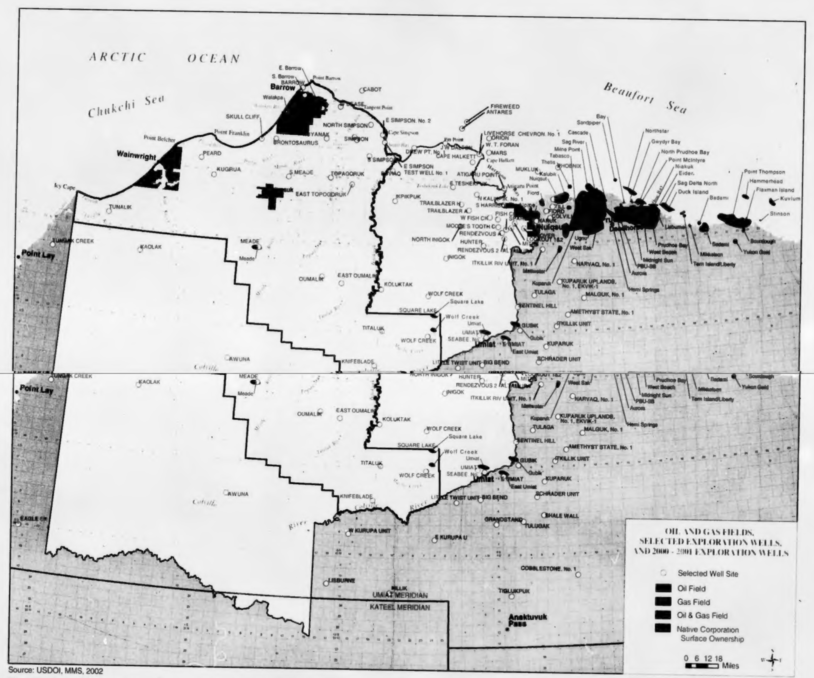
MAP 22



Source: USDOI, MMS, 2002

Map 26. Selected Exploration Wells and Recent Exploratory Wells (2000 - 2001) in NPR-A and Prudhoe Bay

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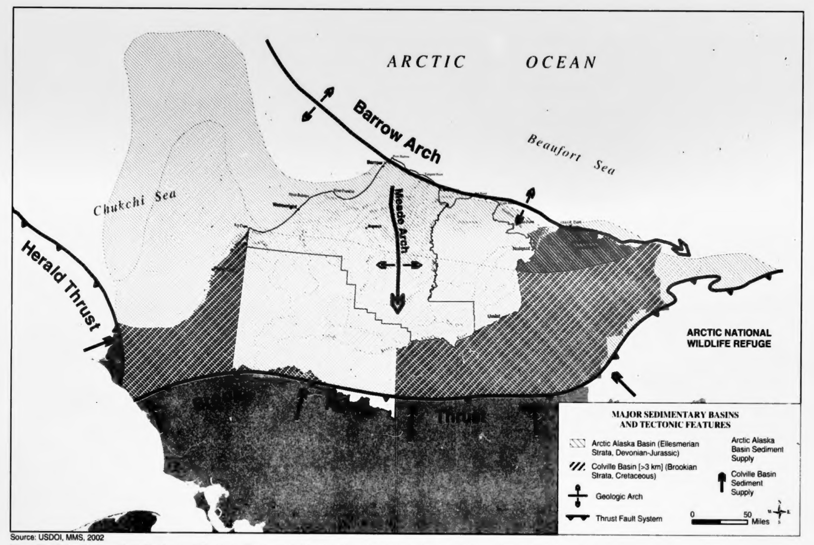
MAP 23


ARCTIC OCEAN
Barrow Arch
Beaufort Sea
Chukchi Sea
Meade Arch
Herald Thrust
Thrust
ARCTIC NATIONAL WILDLIFE REFUGE
MAJOR SEDIMENTARY BASINS AND TECTONIC FEATURES
Arctic Alaska Basin (Ellesmerian Strata, Devonian-Jurassic)
Colville Basin [>3 km] (Brookian Strata, Cretaceous)
Geologic Arch
Thrust Fault System
Arctic Alaska Basin Sediment Supply
Colville Basin Sediment Supply
0
50
Miles
N

Source: USDOI, MMS, 2002

Map 27. Major Sedimentary Basins and Tectonic Features in Northern Alaska and Contiguous Offshore Continental Shelves

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MAP 24

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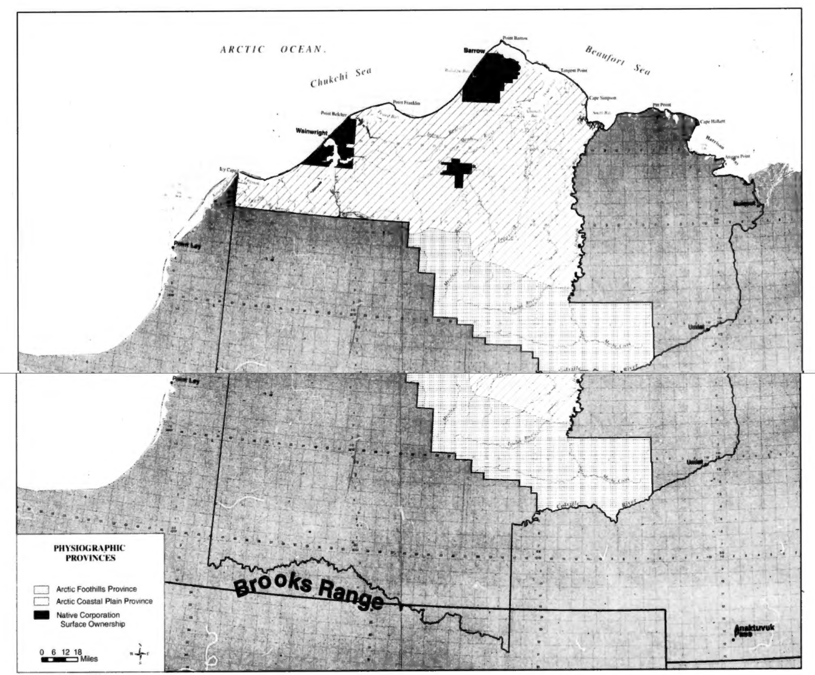
MAP 24



Source: Wahrhaftig, 1965

Map 28. NW NPR-A Physiographic Provinces

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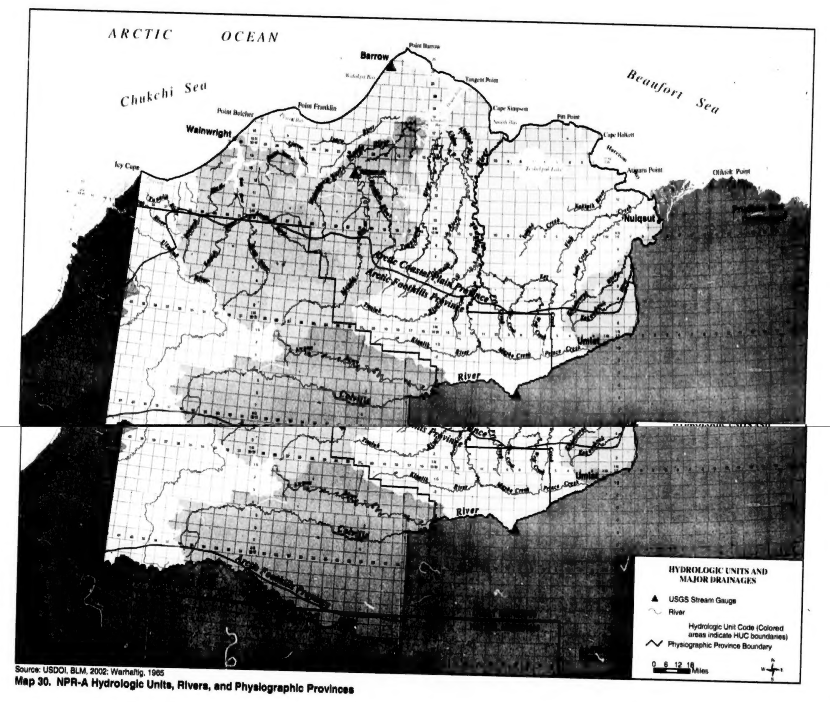
MAP 25



Source: USDOI, BLM, 2002; Warhaftig, 1965

Map 30. NPR-A Hydrologic Units, Rivers, and Physiographic Provinces

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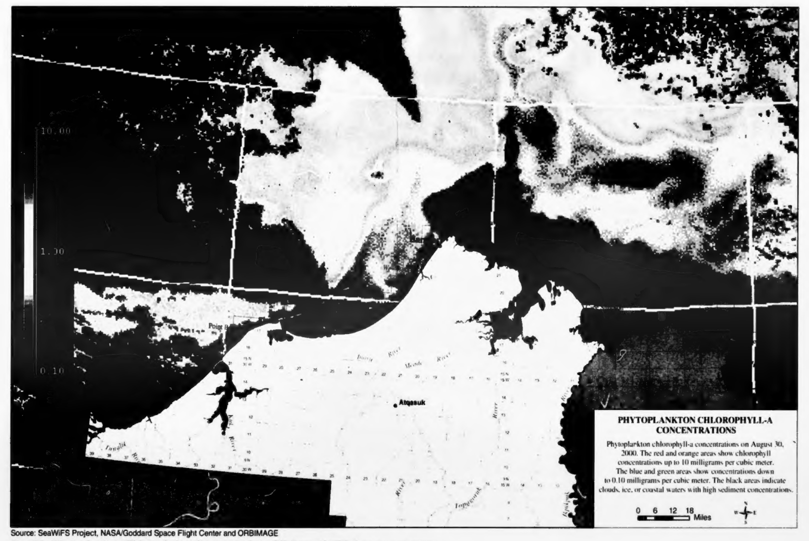
MAP 26



PHYTOPLANKTON CHLOROPHYLL-A CONCENTRATIONS

Phytoplankton chlorophyll-a concentrations on August 30, 2000. The red and orange areas show chlorophyll concentrations up to 10 milligrams per cubic meter. The blue and green areas show concentrations down to 0.10 milligrams per cubic meter. The black areas indicate clouds, ice, or coastal waters with high sediment concentrations.

Source: SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE

Map 31. Phytoplankton Chlorophyll-A Concentrations Offshore of NPR-A in August 2000

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MAP 28

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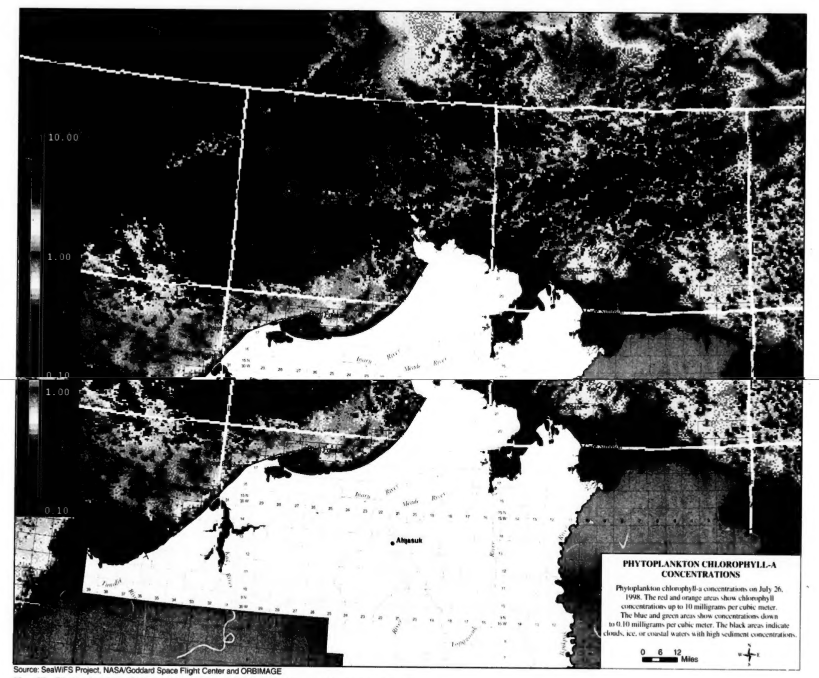
MAP 28



PHYTOPLANKTON CHLOROPHYLL-A CONCENTRATIONS

Phytoplankton chlorophyll-a concentrations on July 26, 1998. The red and orange areas show chlorophyll concentrations up to 10 milligrams per cubic meter. The blue and green areas show concentrations down to 0.10 milligrams per cubic meter. The black areas indicate clouds, ice, or coastal waters with high sediment concentrations.

Source: SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE

Map 33. Phytoplankton Chlorophyll-A Concentrations Offshore of NPR-A in July 1998

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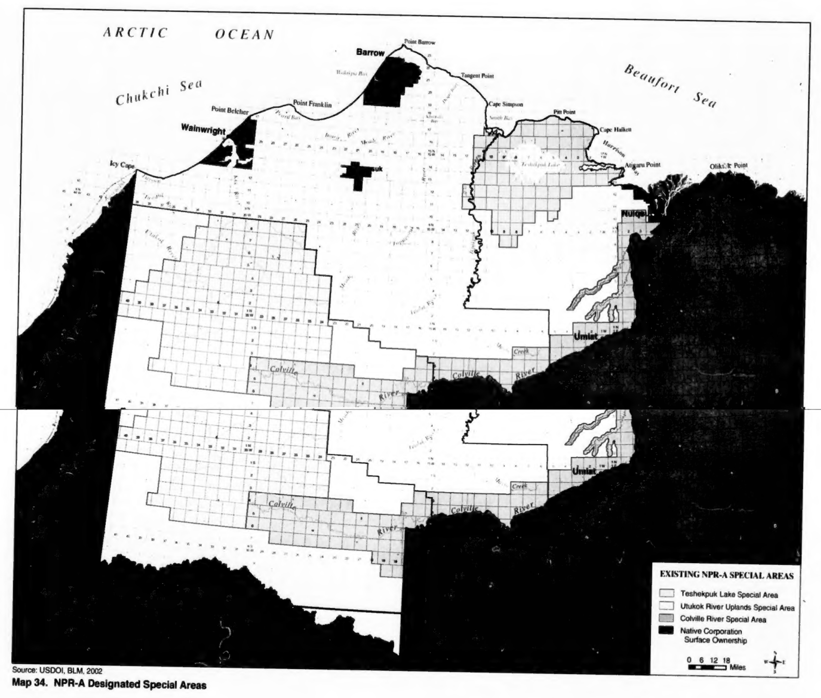
MAP 29



Source: USDOI, BLM, 2002

Map 34. NPR-A Designated Special Areas

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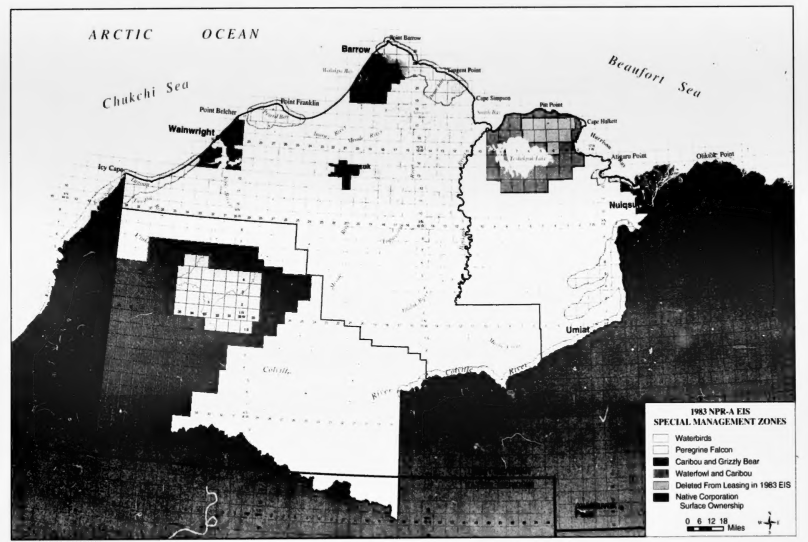

Source: USDOI, BLM, 2002
Map 35. NPR-A Special Management Zones

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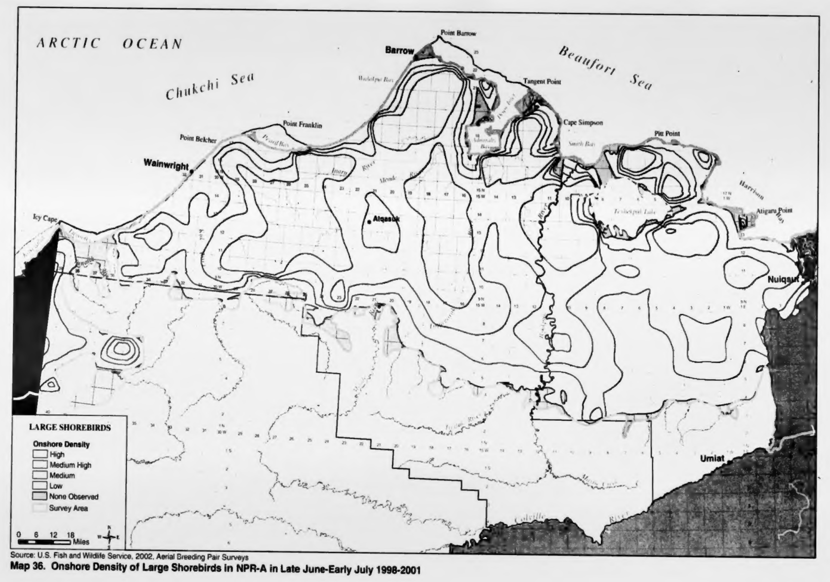
MAP 31



Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys

Map 36. Onshore Density of Large Shorebirds in NPR-A in Late June-Early July 1998-2001

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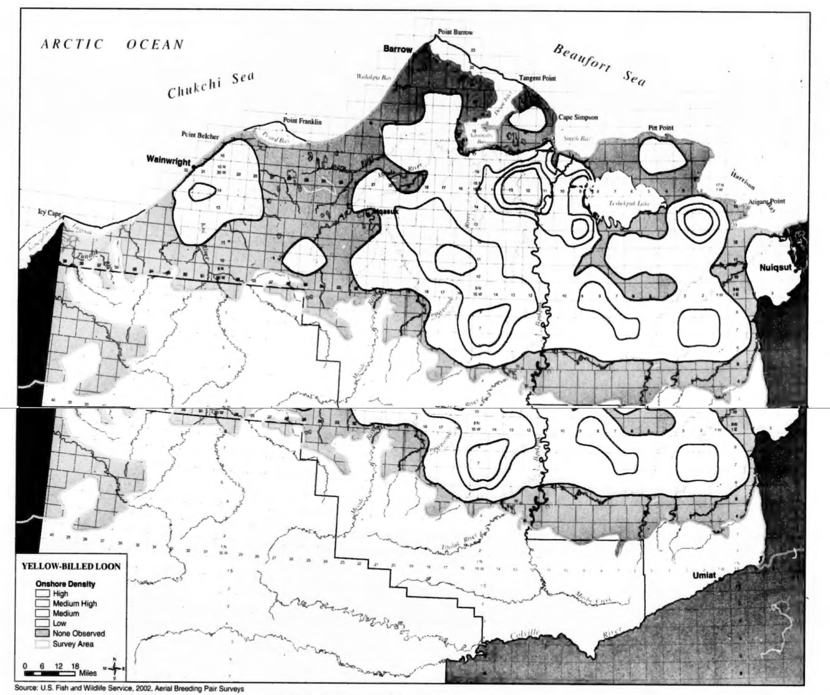
MAP 32

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 32



Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys

Map 37. Onshore Density of Yellow-billed Loons in NPR-A in Late June-Early July 1998-2001

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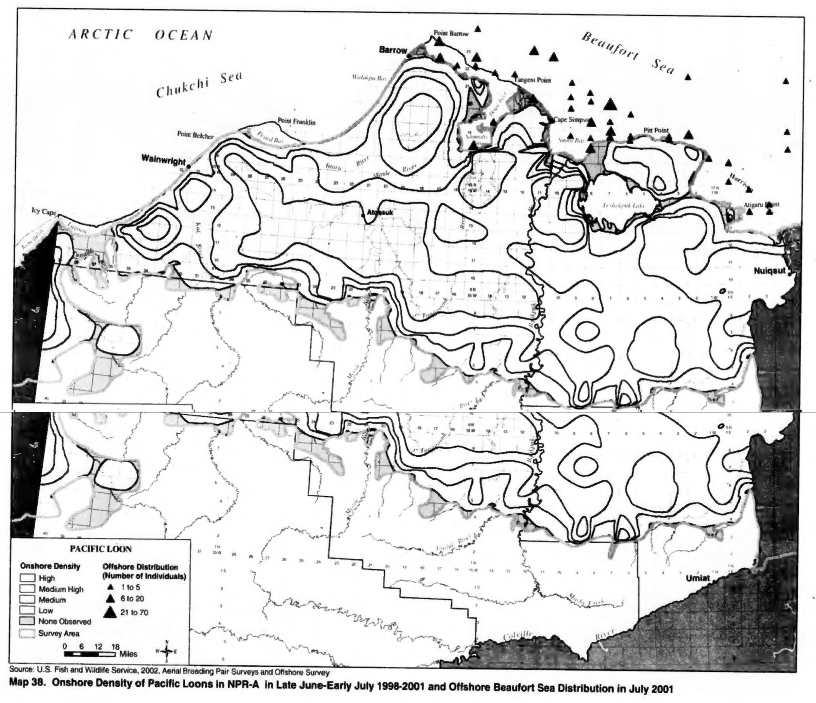
MAP 33



Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys and Offshore Survey

Map 38. Onshore Density of Pacific Loons in NPR-A in Late June-Early July 1998-2001 and Offshore Beaufort Sea Distribution in July 2001

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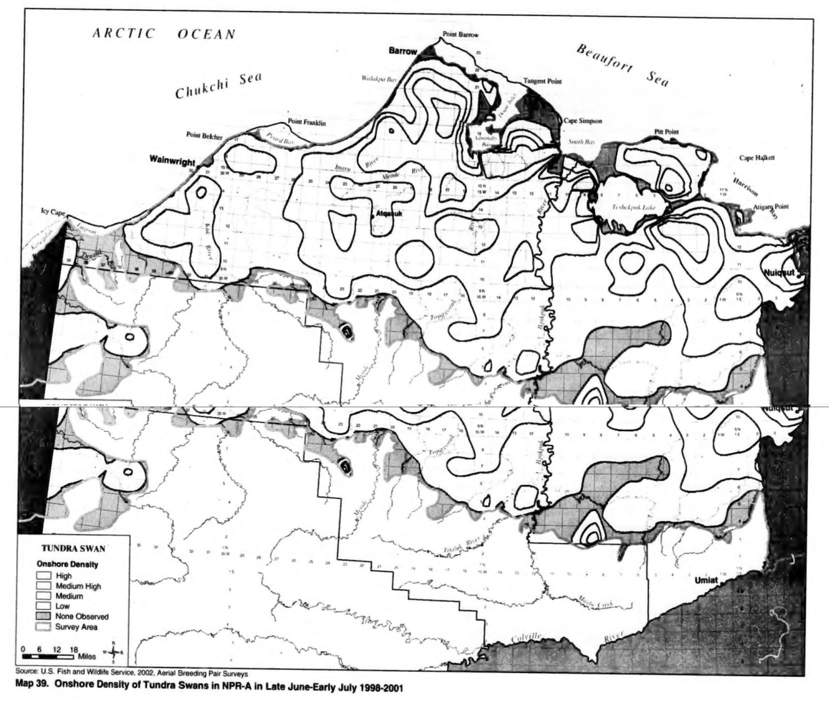
MAP 34



Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys

Map 39. Onshore Density of Tundra Swans in NPR-A in Late June-Early July 1998-2001

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MAP 35

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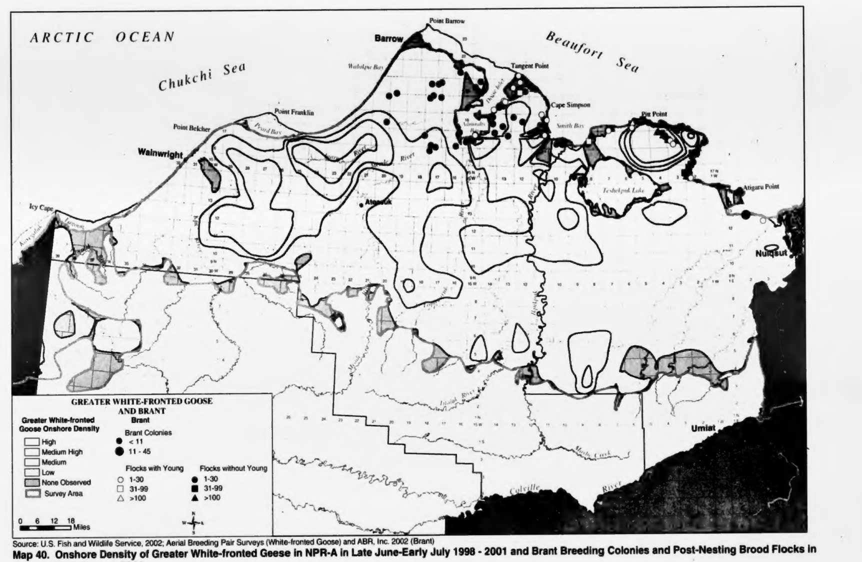

Source: U.S. Fish and Wildlife Service, 2002; Aerial Breeding Pair Surveys (White-fronted Goose) and ABR, Inc. 2002 (Brant)

Map 40. Onshore Density of Greater White-fronted Geese in NPR-A in Late June-Early July 1998 - 2001 and Brant Breeding Colonies and Post-Nesting Brood Flocks in June and July/August 2001

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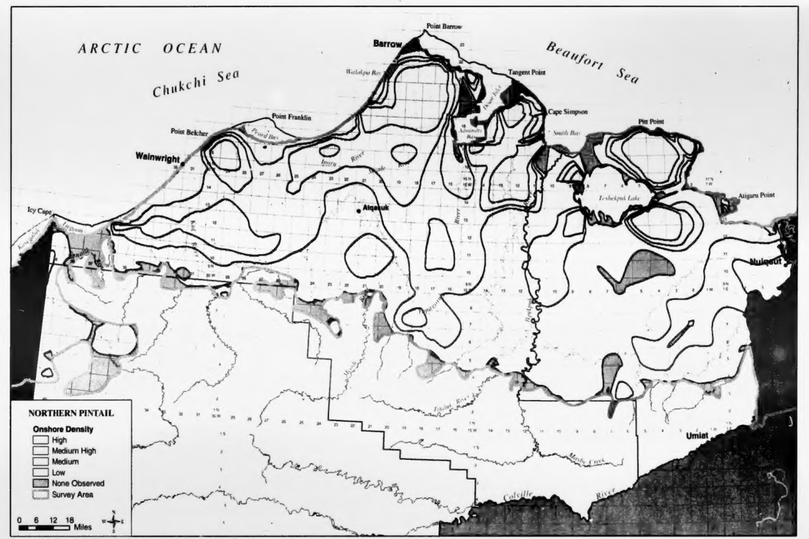

Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys

Map 41. Onshore Density of Northern Pintails in NPR-A in Late June-Early July 1998-2001

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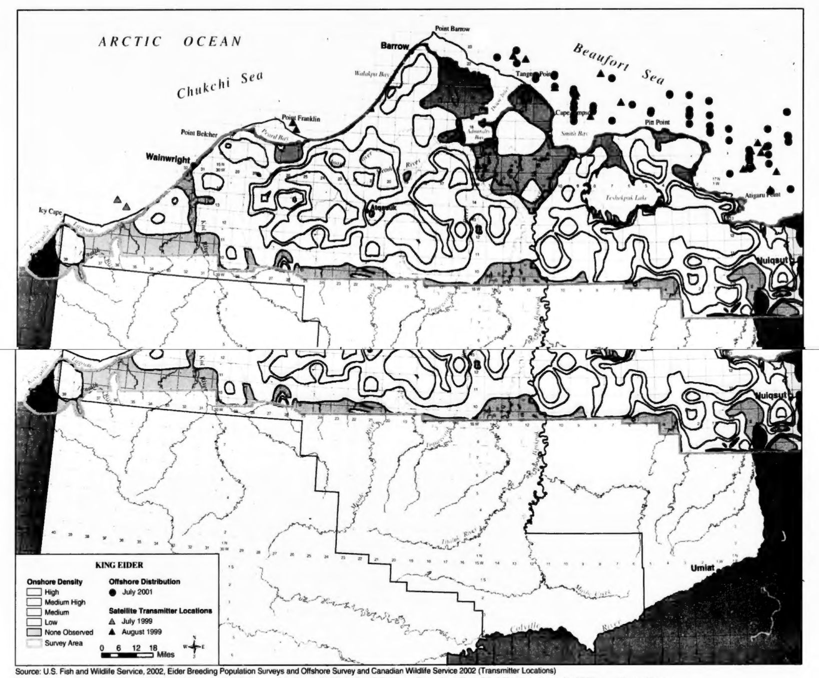
MAP 38



Source: U.S. Fish and Wildlife Service, 2002, Eider Breeding Population Surveys and Offshore Survey and Canadian Wildlife Service 2002 (Transmitter Locations)

Map 43. Onshore Density of King Eiders in NPR-A in mid-June 1998-2001, Offshore Beaufort Sea Distribution in July 2001, and Locations of Transmitter-Equipped Individuals in July and August 1999

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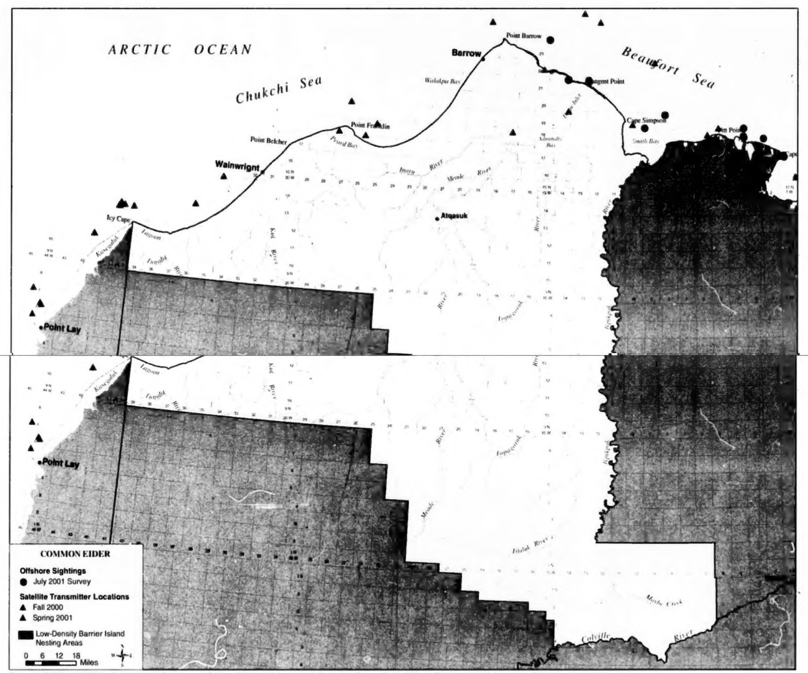
MAP 39

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 39



Source: U.S. Fish and Wildlife Service, Aerial Surveys, and Offshore Survey, 2002, and U.S. Geological Survey Alaska Science Center, trasmitter locations, 2002

Map 44. Common Eider Nesting Areas, Location of Transmitter-Equipped Females in Fall 2000 and Spring 2001, and Offshore Distribution in July 2001

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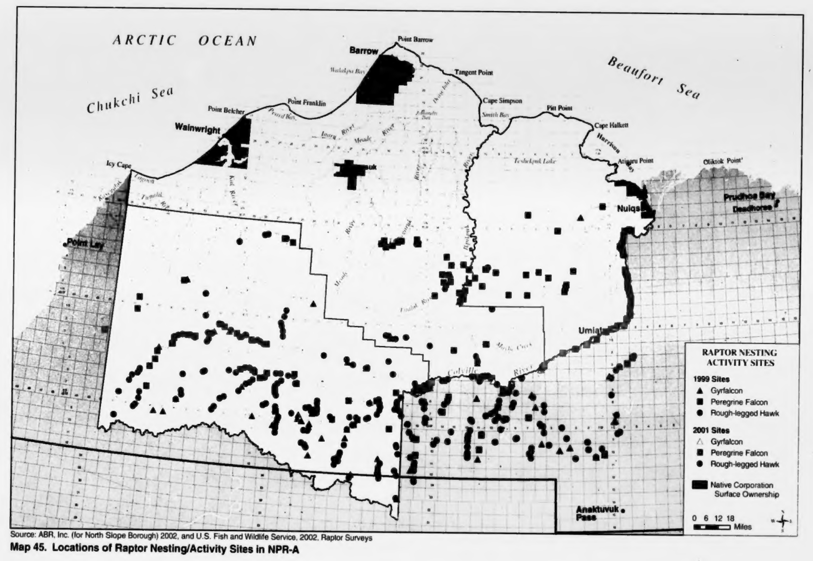
MAP 40



Source: ABR, Inc. (for North Slope Borough) 2002, and U.S. Fish and Wildlife Service, 2002, Raptor Surveys

Map 45. Locations of Raptor Nesting/Activity Sites in NPR-A

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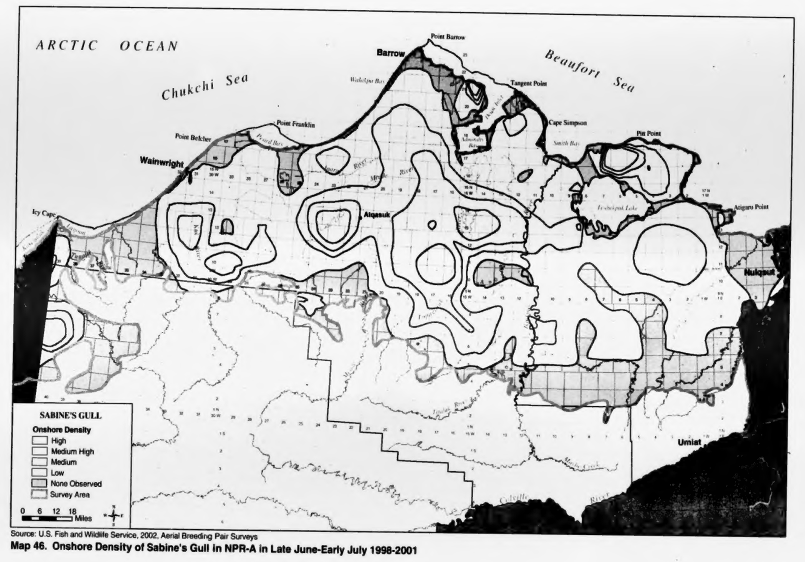
MAP 41



Source: U.S. Fish and Wildlife Service, 2002, Aerial Breeding Pair Surveys

Map 46. Onshore Density of Sabine's Gull in NPR-A in Late June-Early July 1998-2001

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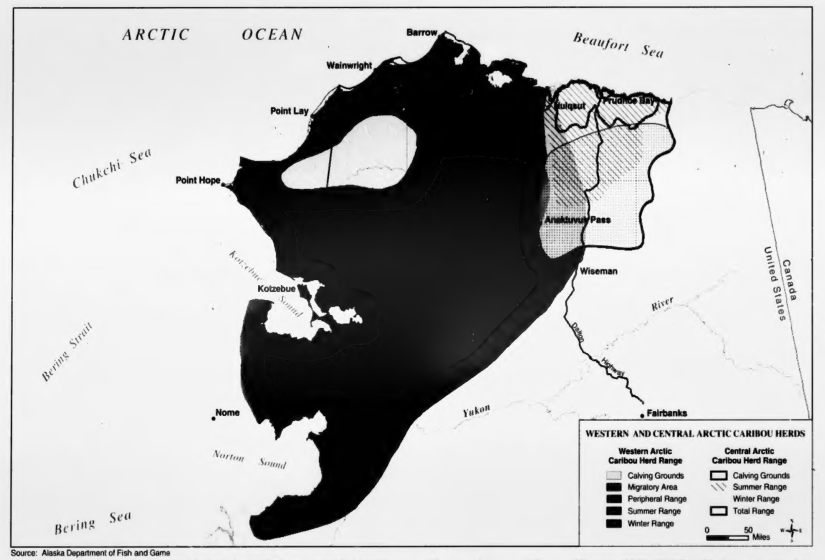

Source: Alaska Department of Fish and Game

Map 47. Western Arctic Caribou and Central Arctic Caribou Herds' Calving Grounds, Migratory Areas, and Seasonal Ranges (1990 -1999 Satellite Telemetry Data)

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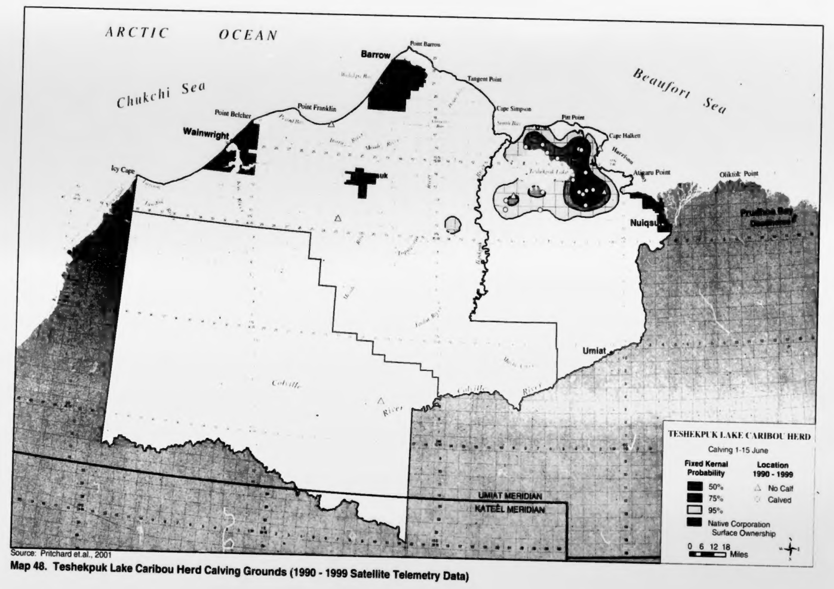

Source: Pritchard et.al., 2001

Map 48. Teshekpuk Lake Caribou Herd Calving Grounds (1990 - 1999 Satellite Telemetry Data)

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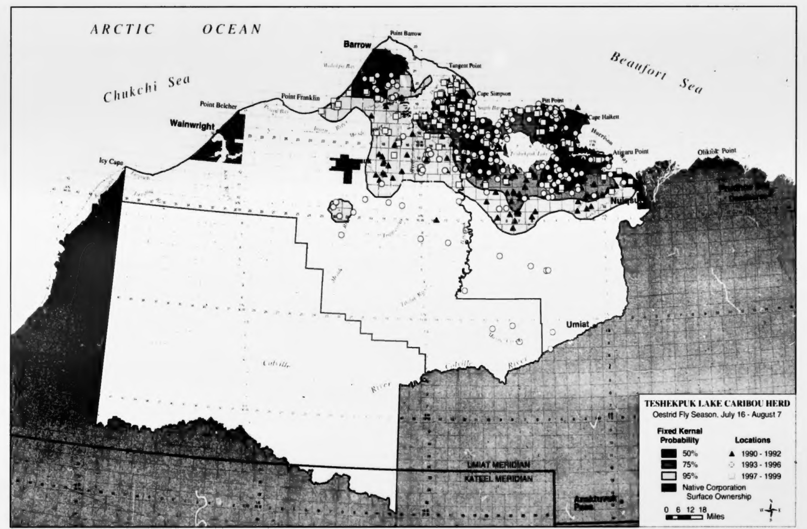

Source: Pritchard et.al., 2001

Map 49. Teshekpuk Lake Caribou Herd Fly Relief Areas (1990 - 1999 Satellite Telemetry Data)

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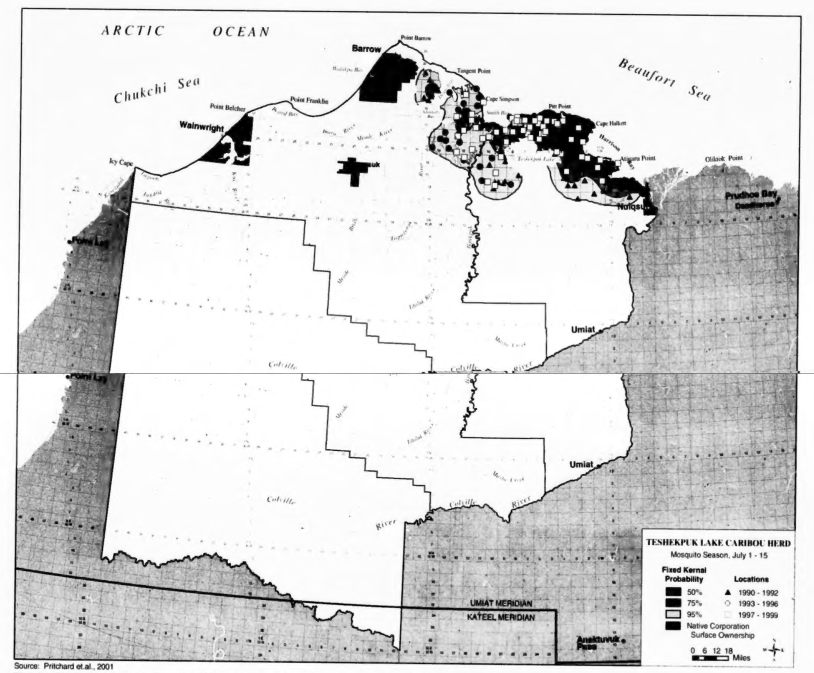
N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 45



Source: Pritchard et.al., 2001

Map 50. Teshekpuk Lake Caribou Herd Mosquito Relief Areas (1990 - 1999 Satellite Telemetry Data)

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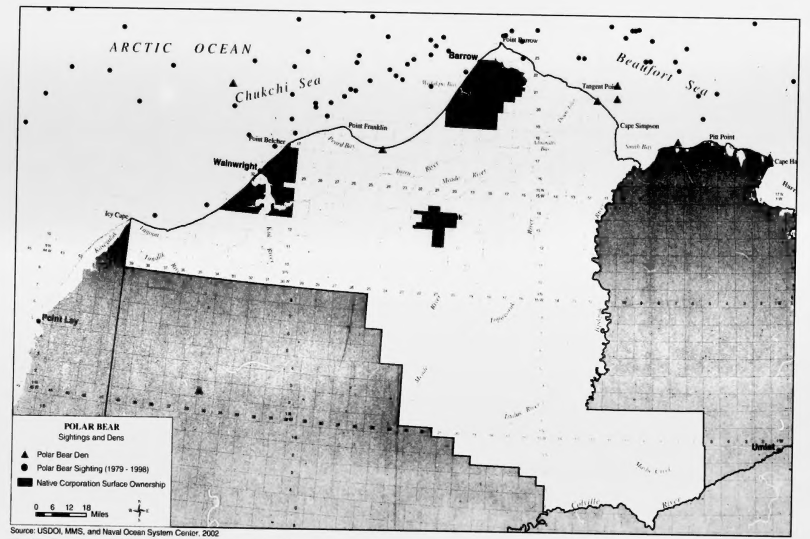

Source: USDOI, MMS, and Naval Ocean System Center, 2002

Map 51. Polar Bear Sightings and Dens Onshore and Offshore of NW NPR-A (1979 - 1998)

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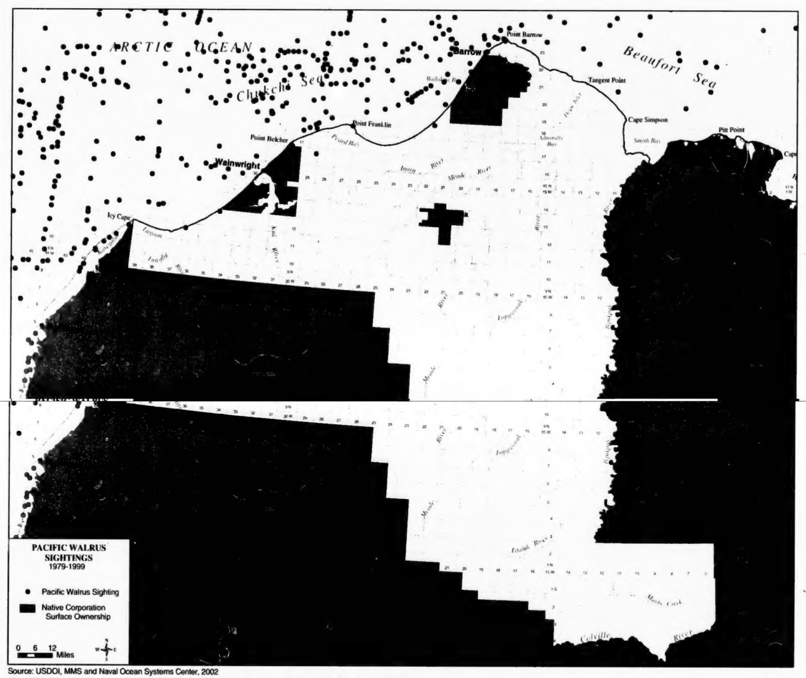
MAP 47



Source: USDOI, MMS and Naval Ocean Systems Center, 2002

Map 52. Pacific Walrus Sightings Onshore and Offshore of NW NPR-A (1979 - 1998)

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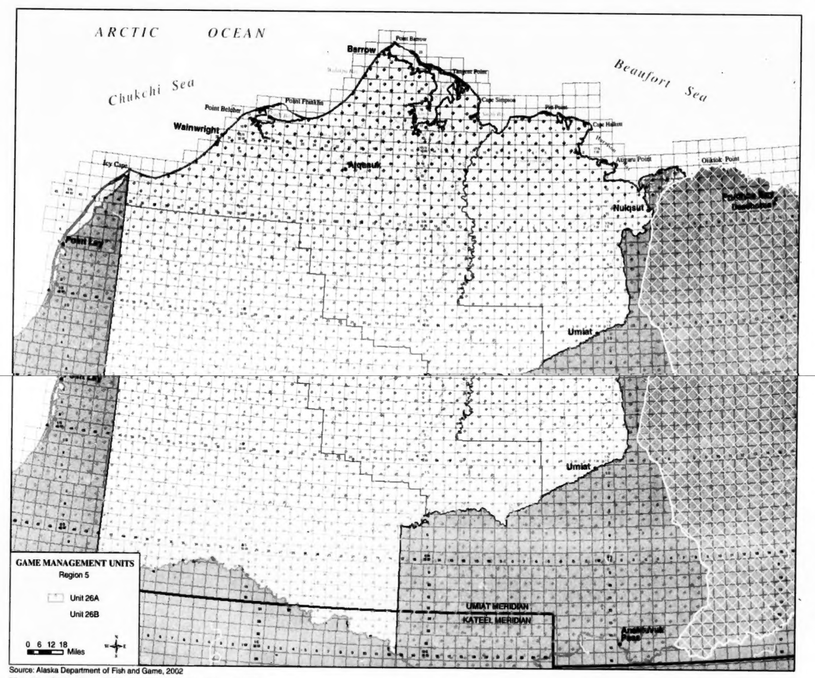
MAP 48

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 48



Source: Alaska Department of Fish and Game, 2002

Map 53. State Game Management Units 26A and 26B

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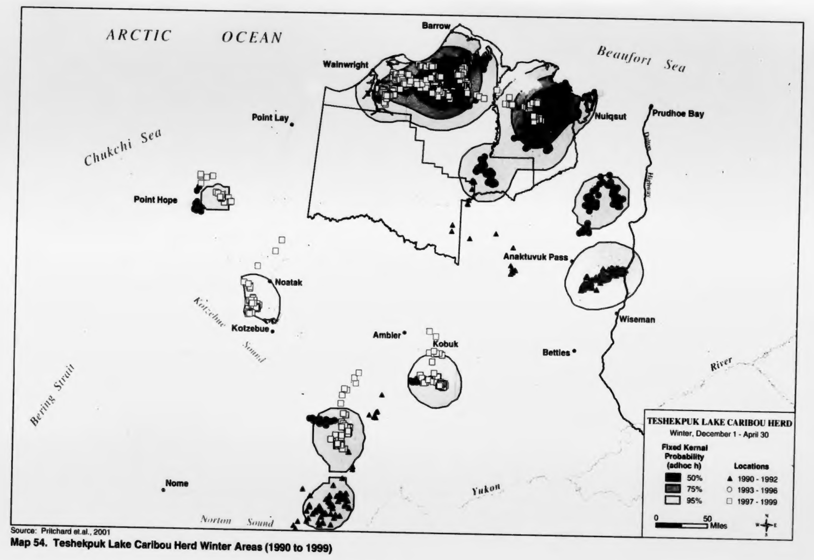
MAP 49



Source: Pritchard et.al., 2001

Map 54. Teshekpuk Lake Caribou Herd Winter Areas (1990 to 1999)

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MAP 50

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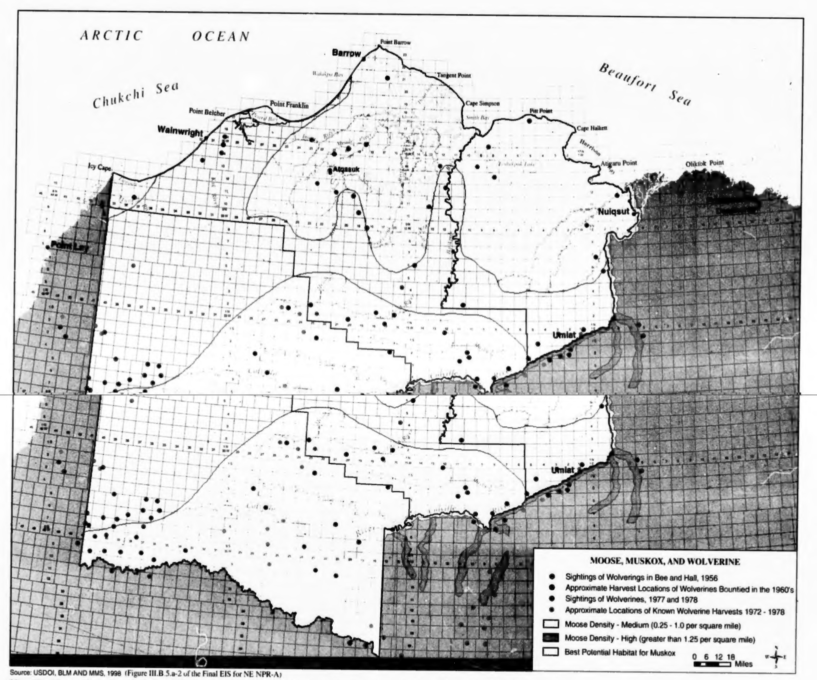
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Tangent Point
Cape Simpson
Pitt Point
Cape Halkett
Atigaru Point
Oliktok Point
Point Franklin
Point Belcher
Wainwright
Icy Cape
Atqasuk
Point Lay
Nuiqsut
Umiat
MOOSE, MUSKOX, AND WOLVERINE
Sightings of Wolverings in Bee and Hall, 1956
Approximate Harvest Locations of Wolverines Bountied in the 1960's
Sightings of Wolverines, 1977 and 1978
Approximate Locations of Known Wolverine Harvests 1972 - 1978
Moose Density - Medium (0.25 - 1.0 per square mile)
Moose Density - High (greater than 1.25 per square mile)
Best Potential Habitat for Muskox
0 6 12 18 Miles

Source: USDOI, BLM AND MMS, 1998 (Figure III.B.5.a-2 of the Final EIS for NE NPR-A)

Map 55. Moose Density, Historical Wolverine Sightings and Harvest Locations, and Prime Muskox Habitat in NPR-A

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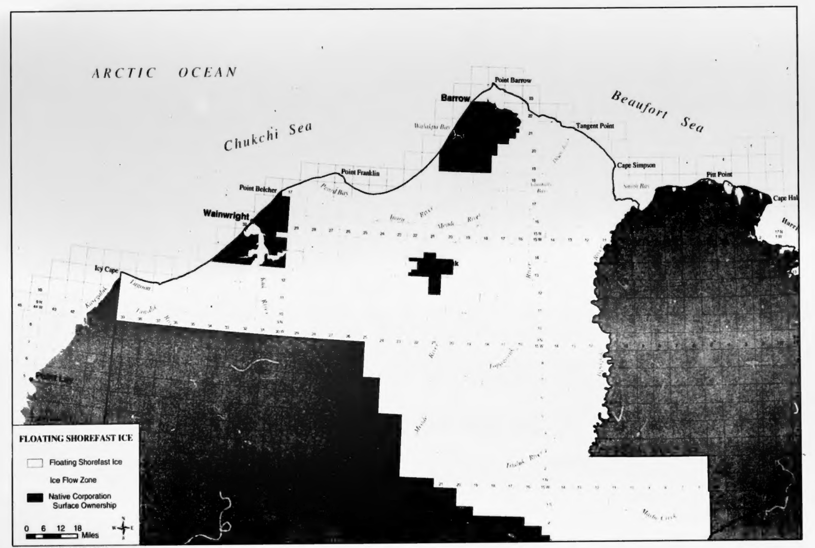

Source: USDOI, MMS, 2002

Map 56. Location of Ice Flow Zone and Floating Shorefast Ice along NPR-A Coastline

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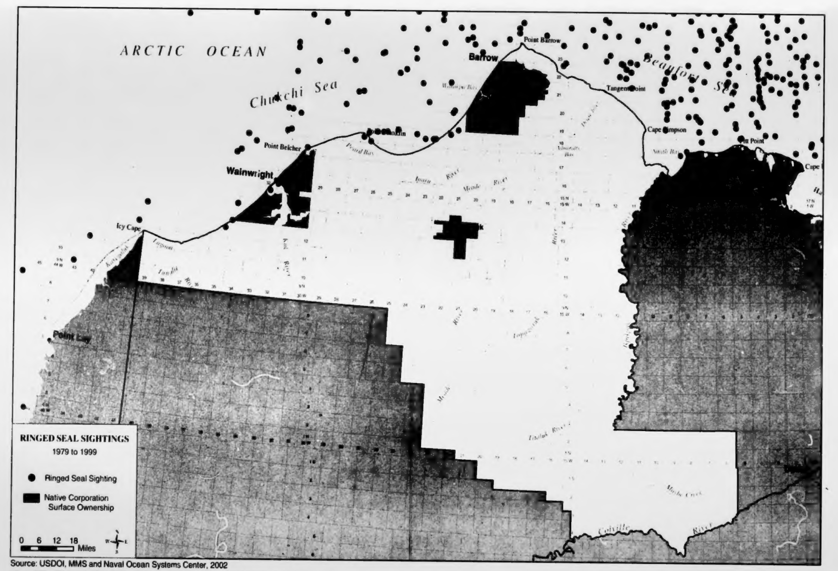
MAP 52



Source: USDOI, MMS and Naval Ocean Systems Center, 2002

Map 57. Ringed Seal Sightings Offshore of NW NPR-A (1979 - 1999)

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MAP 53

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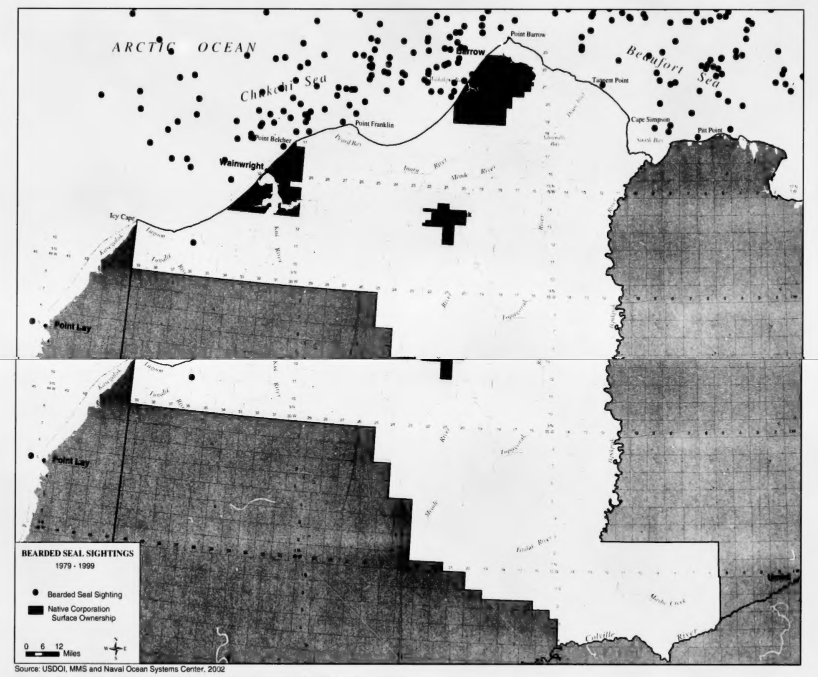
MAP 53



Source: USDOI, MMS and Naval Ocean Systems Center, 2002

Map 58. Bearded Seal Sightings Offshore and Onshore of NW NPR-A (1979 - 1999)

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MAP 54

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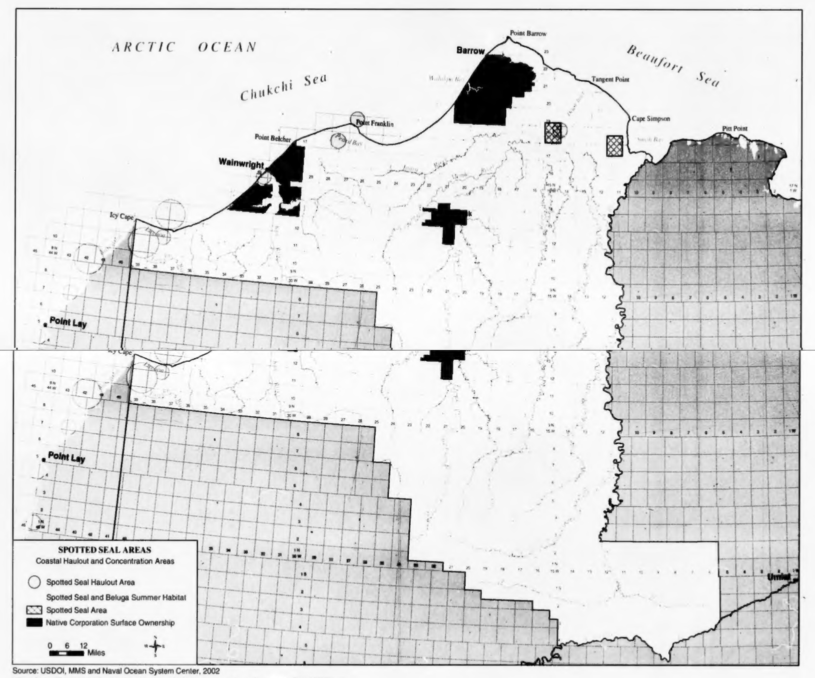
MAP 54



Source: USDOI, MMS and Naval Ocean System Center, 2002

Map 59. Spotted Seal Haulout and Concentration Areas in NW NPR-A

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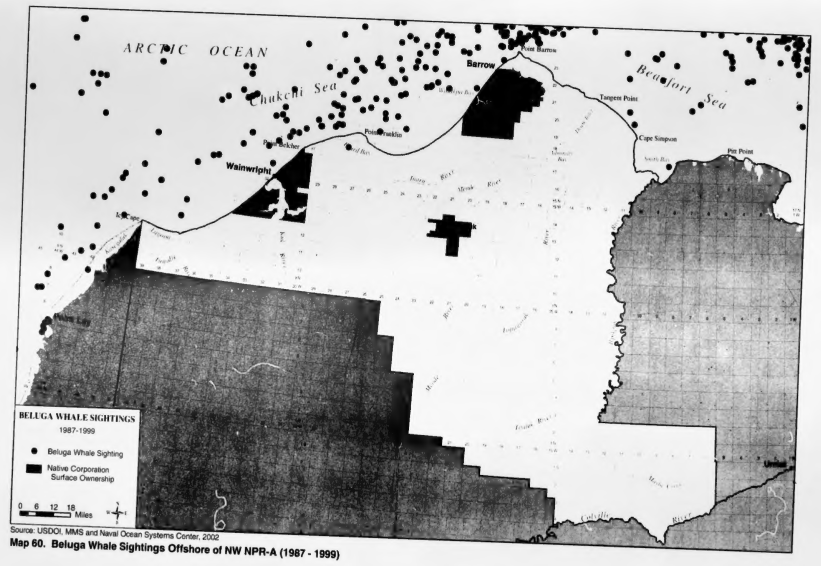
MAP 55



Source: USDOI, MMS and Naval Ocean Systems Center, 2002

Map 60. Beluga Whale Sightings Offshore of NW NPR-A (1987 - 1999)

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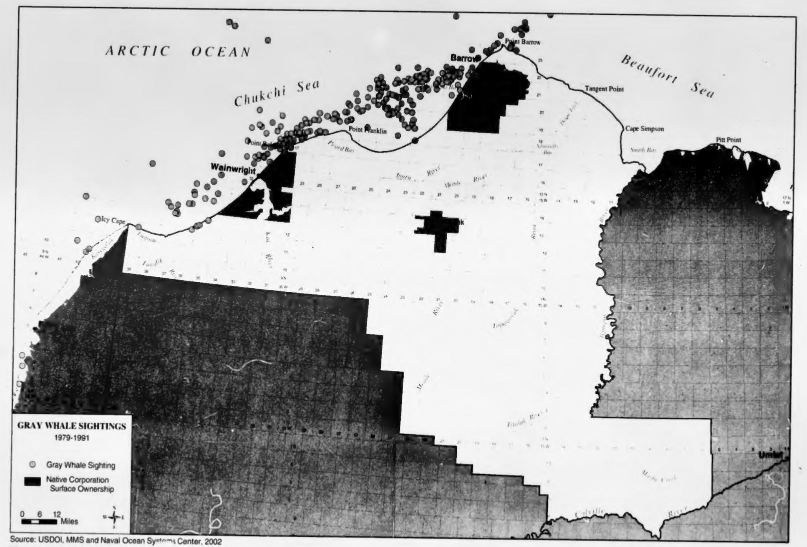
MAP 56



Source: USDOI, MMS and Naval Ocean Systems Center, 2002

Map 61. Gray Whale Sightings Offshore of NW NPR-A (1979 - 1991)

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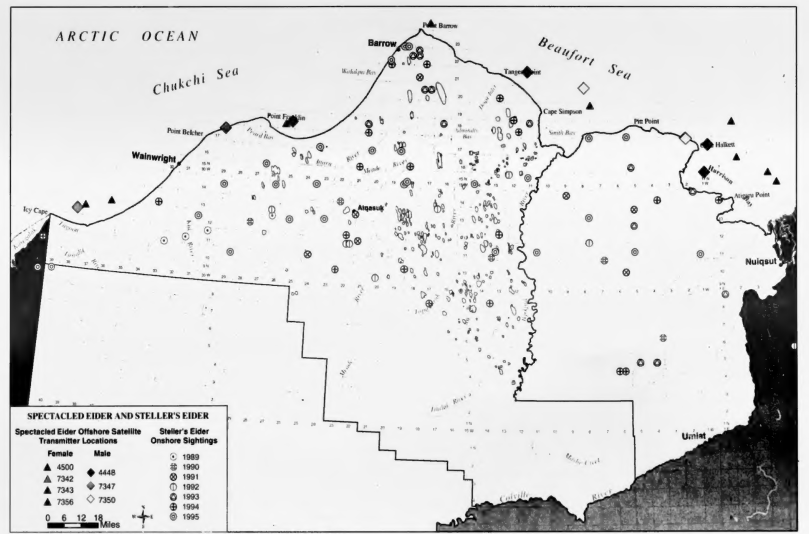
MAP 58



Source: U.S. Geological Survey Alaska Science Center 2002 and U.S. Fish and Wildlife Service 2002

Map 63. Offshore Locations of Satellite Transmitter-Equipped Spectacled Eiders in Summer 1995 and 1996 and Onshore Sightings of Steller's Eiders 1989-1995

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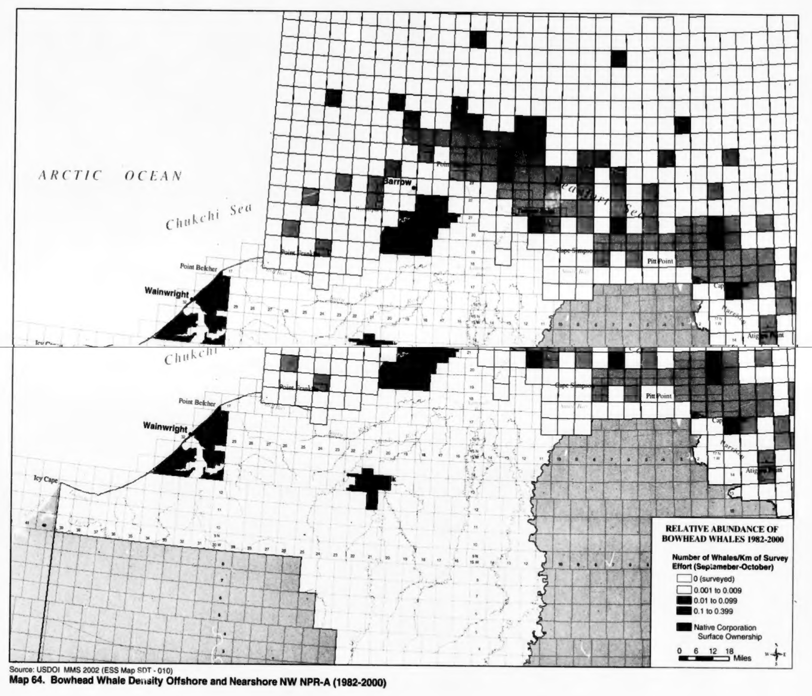
MAP 59

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 59



Source: USDOI MMS 2002 (ESS Map SDT - 010)

Map 64. Bowhead Whale Density Offshore and Nearshore NW NPR-A (1982-2000)

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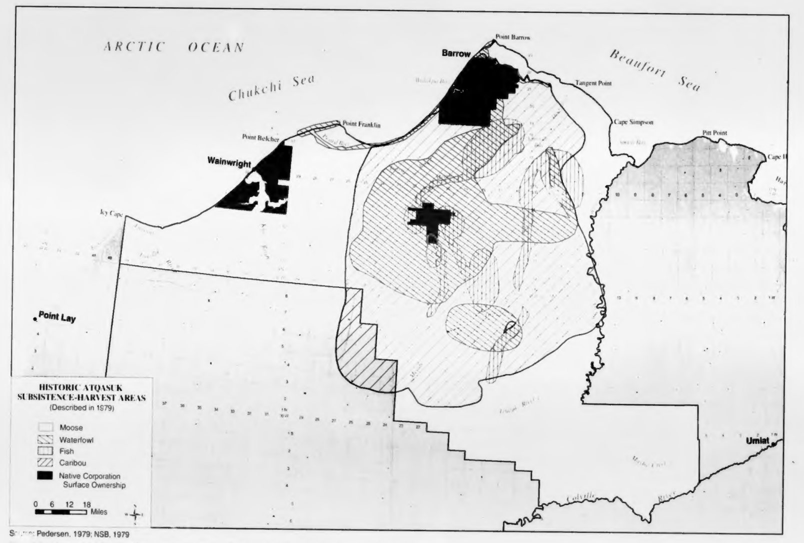

Source: Pedersen, 1979; NSB, 1979

Map 76. Atqasuk Lifetime Subsistence-Harvest Areas for Moose, Caribou, Fish, and Birds

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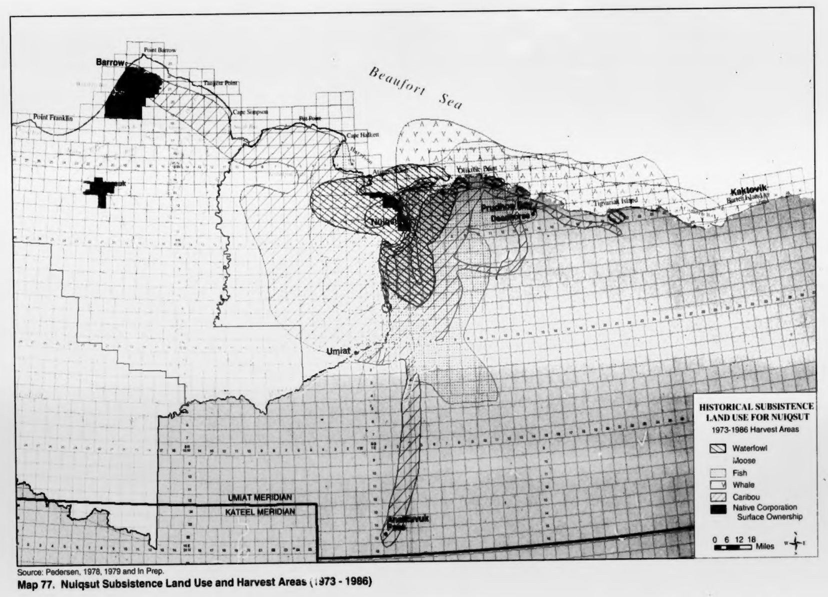

Source: Pedersen, 1978, 1979 and In Prep.

Map 77. Nuiqsut Subsistence Land Use and Harvest Areas (1973 - 1986)

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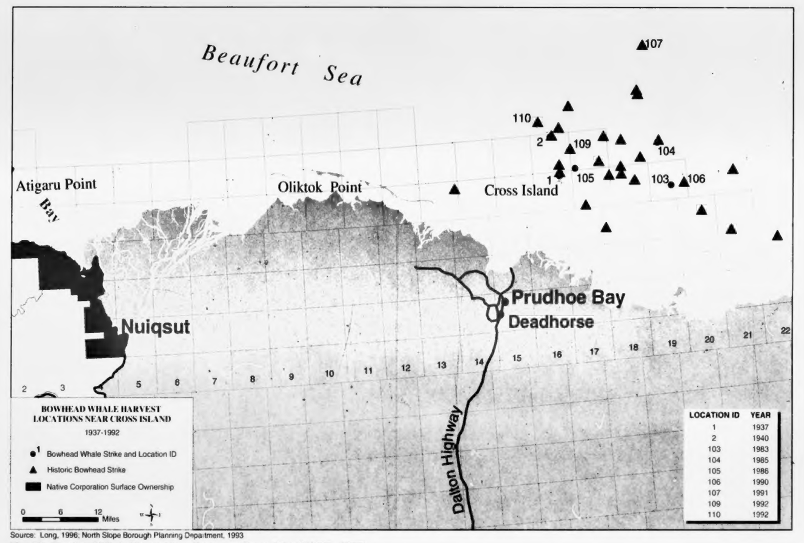
MAP 62



LOCATION ID	YEAR
1	1937
2	1940
103	1983
104	1985
105	1986
106	1990
107	1991
109	1992
110	1992

Source: Long, 1996; North Slope Borough Planning Department, 1993

Map 78. Bowhead Whale Harvest Locations near Cross Island (1937 - 1992)

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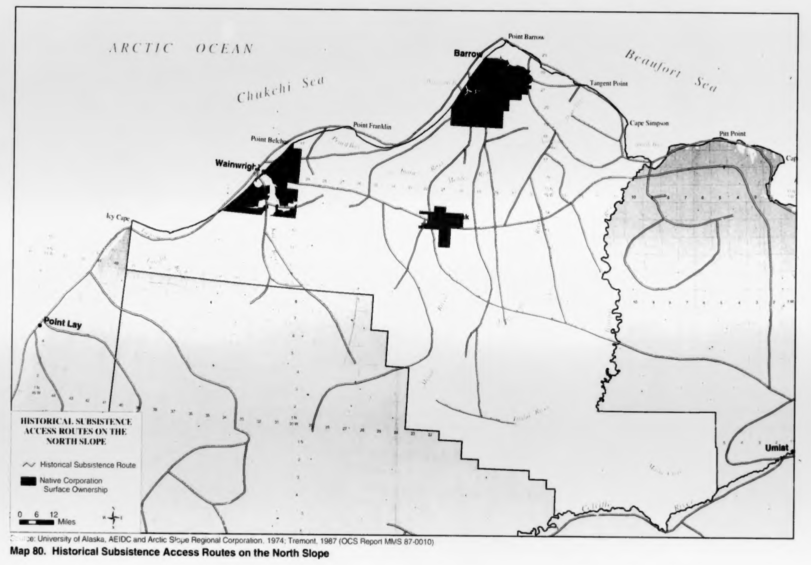
MAP 63



Source: University of Alaska, AEIDC and Arctic Slope Regional Corporation, 1974; Tremont, 1987 (OCS Report MMS 87-0010)

Map 80. Historical Subsistence Access Routes on the North Slope

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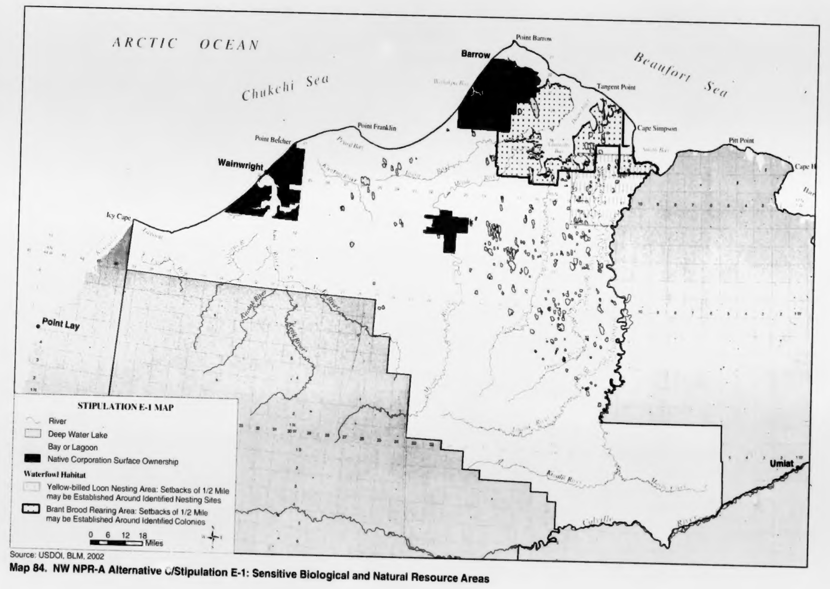
MAP 64



Source: USDOI, BLM, 2002

Map 84. NW NPR-A Alternative C/Stipulation E-1: Sensitive Biological and Natural Resource Areas

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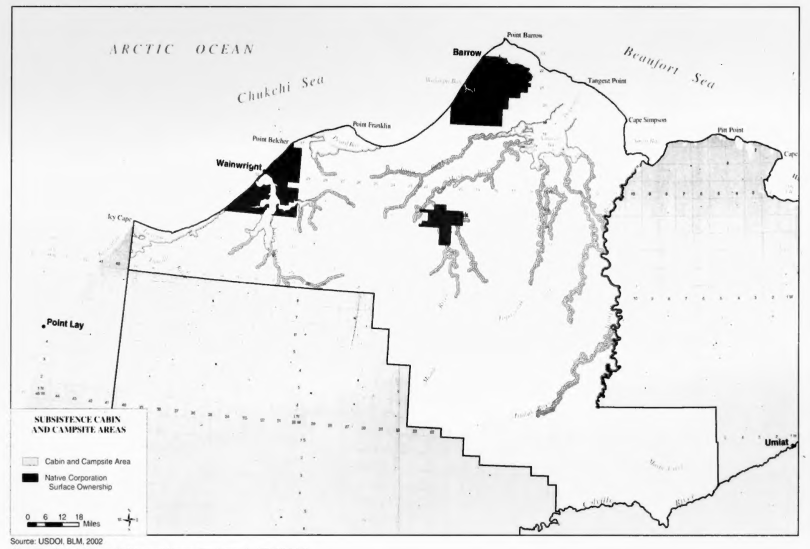
MAP 65



Source: USDOI, BLM, 2002

Map 85. Subsistence Cabin and Campsite Areas in NW NPR-A

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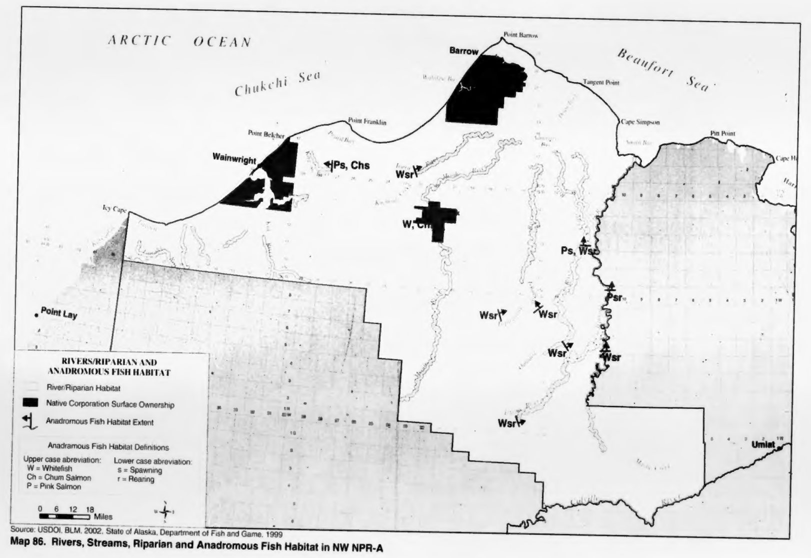
MAP 66



Source: USDOI, BLM, 2002, State of Alaska, Department of Fish and Game, 1999

Map 86. Rivers, Streams, Riparian and Anadromous Fish Habitat in NW NPR-A

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MAP 67

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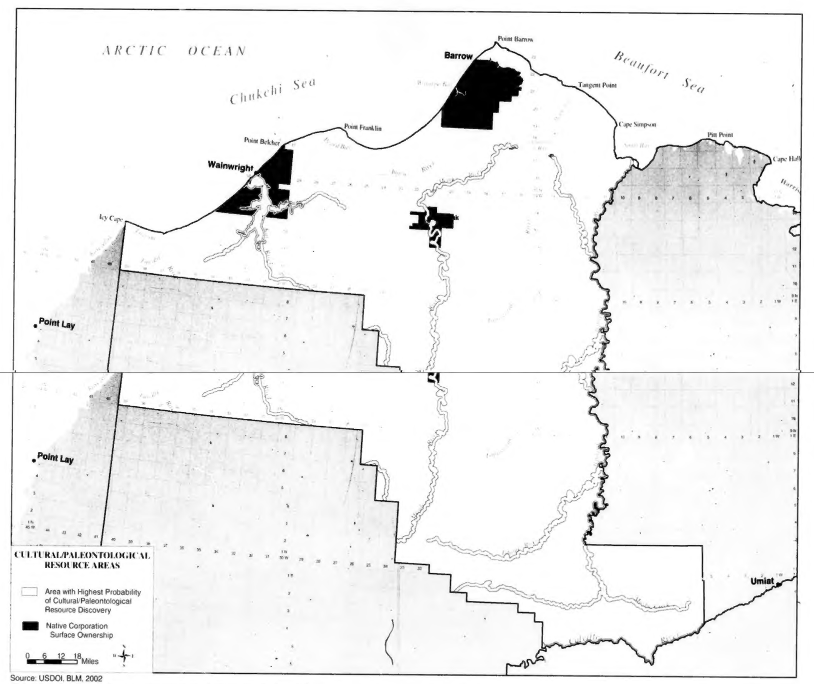
MAP 67



Source: USDOI, BLM, 2002

Map 87. NW NPR-A Areas of Highest Probability for Cultural/Paleontological Resource Discoveries

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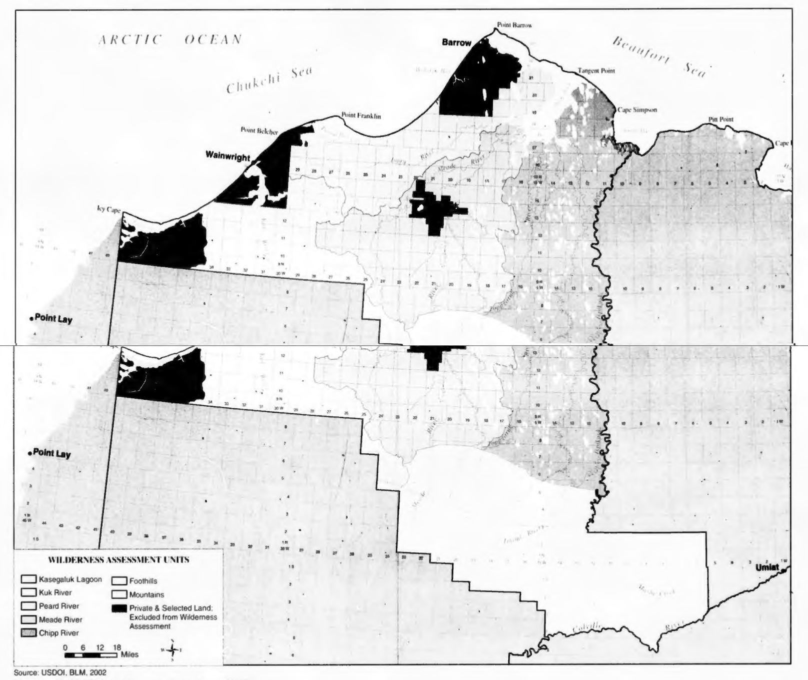

Source: USDOI, BLM, 2002

Map 88. NW NPR-A Wilderness Assessment Units

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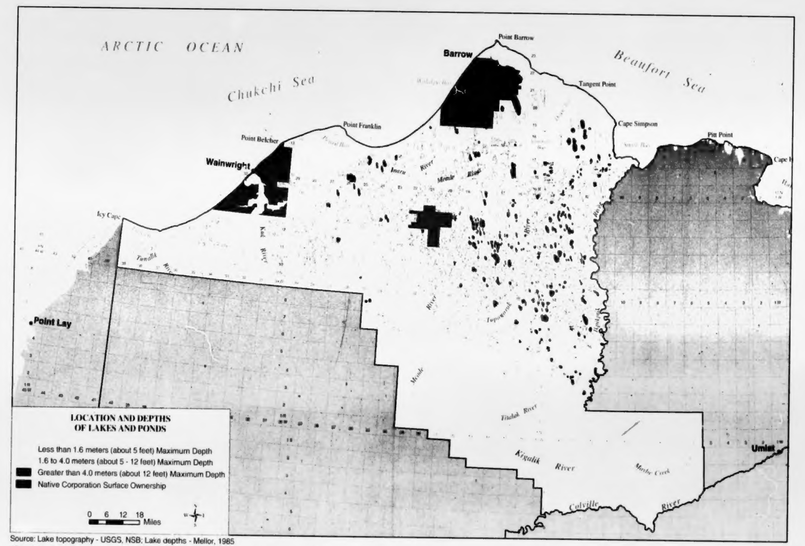
MAP 69



Source: Lake topography - USGS, NSB; Lake depths - Mellor, 1985

Map 89. Locations and Depths of Lakes and Ponds in NW NPR-A

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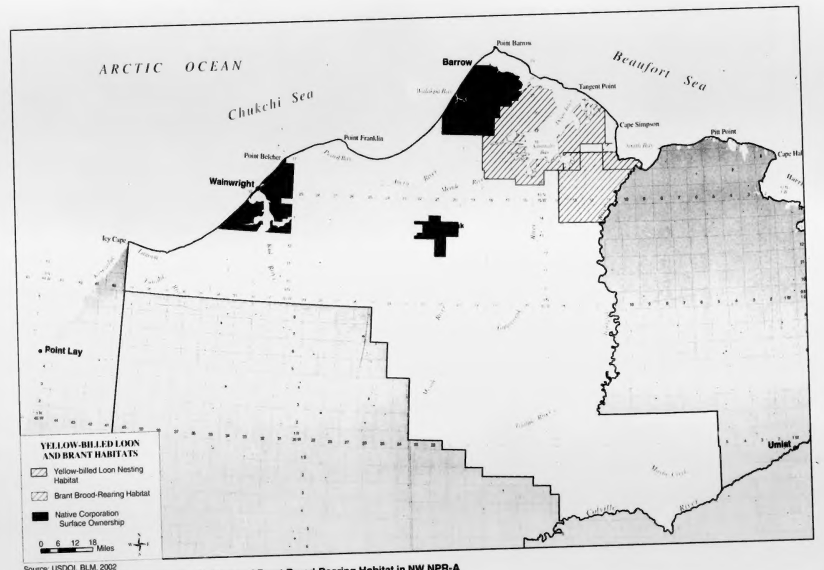
MAP 70



Source: USDOI, BLM, 2002

Map 90. Yellow-billed Loon Nesting Habitat and Brant Brood-Rearing Habitat in NW NPR-A

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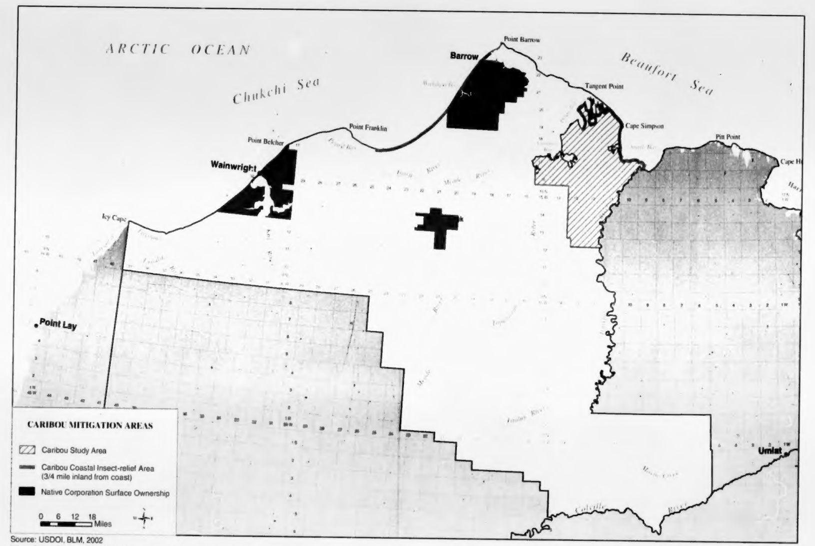

Source: USDOI, BLM, 2002

Map 91. Caribou Mitigation Areas in NW NPR-A

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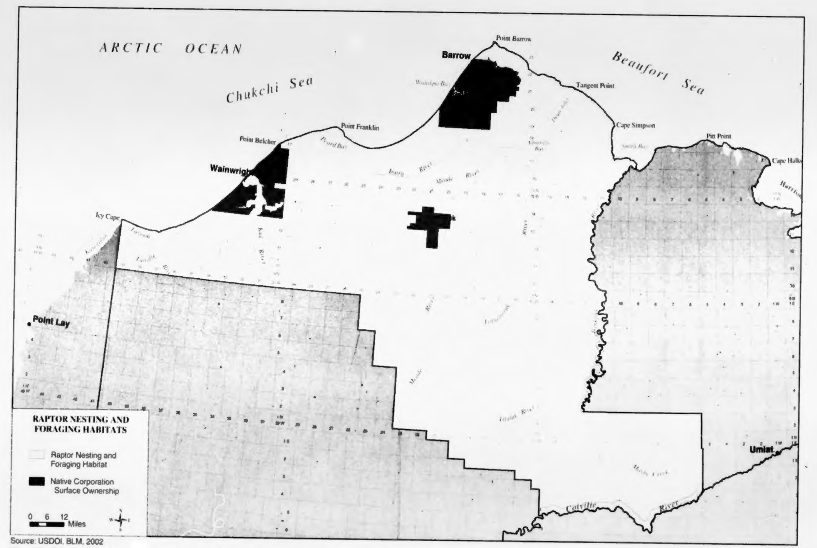
MAP 72



Source: USDOI, BLM, 2002

Map 92. Raptor Nesting and Foraging Habitats in NW NPR-A

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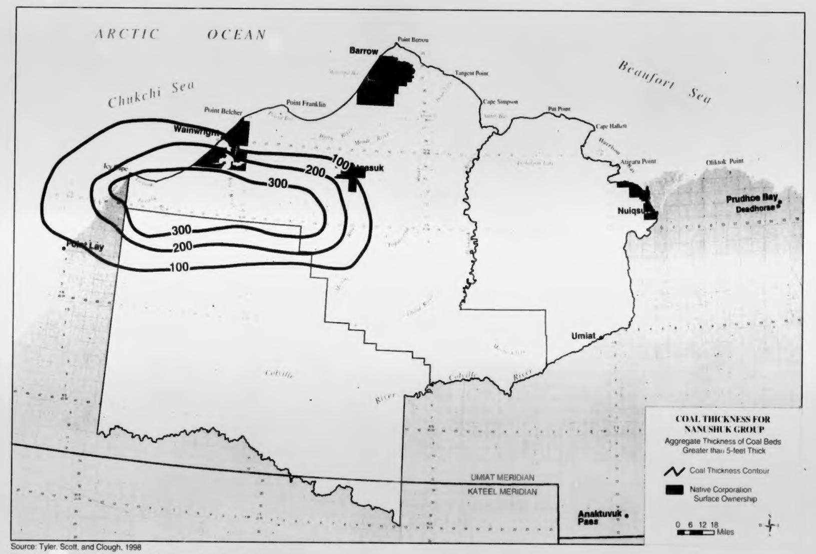
MAP 73



Source: Tyler, Scott, and Clough, 1998

Map 93. Coal Bed Thickness for Nanushuk Group in NW NPR-A

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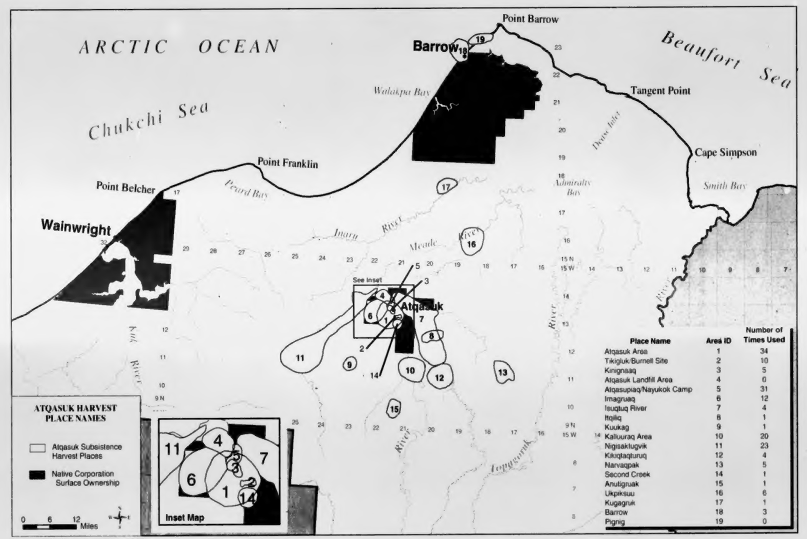
MAP 74



Place Name	Area ID	Number of Times Used
Atqasuk Area	1	34
Tikigluk/Burnell Site	2	10
Kinignaaq	3	5
Atqasuk Landfill Area	4	0
Atqasupiaq/Nayukok Camp	5	31
Imagruaq	6	12
Isuqtuq River	7	4
Itqiliq	8	1
Kuukag	9	1
Kalluuraq Area	10	20
Nigisaktugvik	11	23
Kikiqtaqturuq	12	4
Narvaqpak	13	5
Second Creek	14	1
Anutigruak	15	1
Ukpiksuu	16	6
Kugagruk	17	1
Barrow	18	3
Pignig	19	0

Source: Opie, Brower, and Bates, 1997

Map 94. Atqasuk Subsistence Harvest Place Names and Frequency of Harvest Area Use (July 1994 - July 1995)

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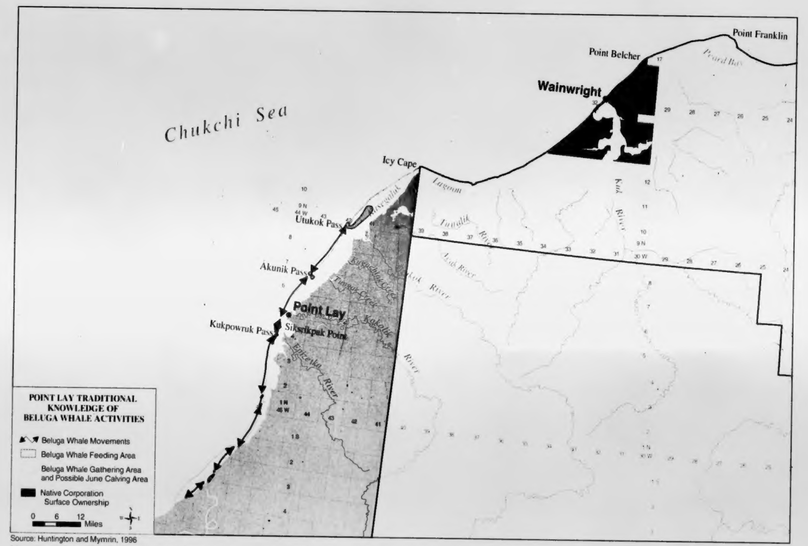
MAP 75



Source: Huntington and Mymrin, 1996

Map 95. Beluga Whale Feeding and Calving Areas and Coastal Movements based on Point Lay Traditional Knowledge

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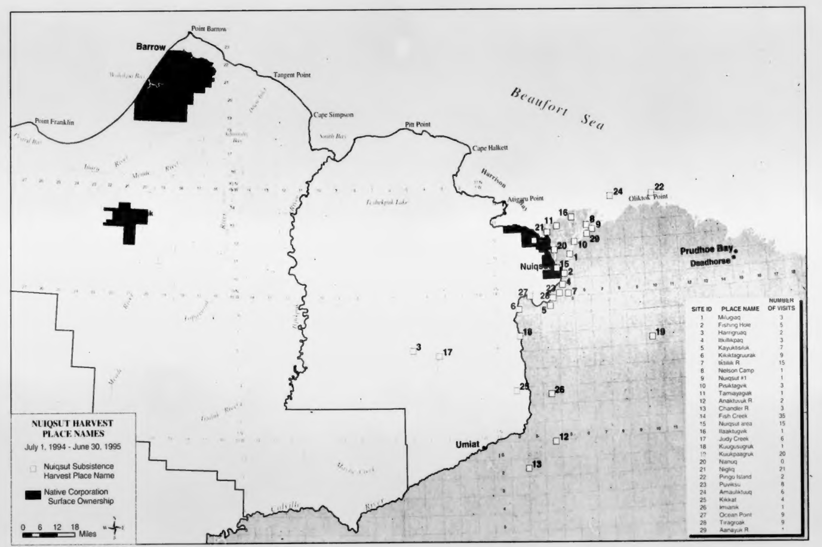

Source: Brower and Opie, 1996

Map 96. Nuiqsut Subsistence Harvest Place Names and Frequency of Harvest Area Use (July 1994 - July 1995)

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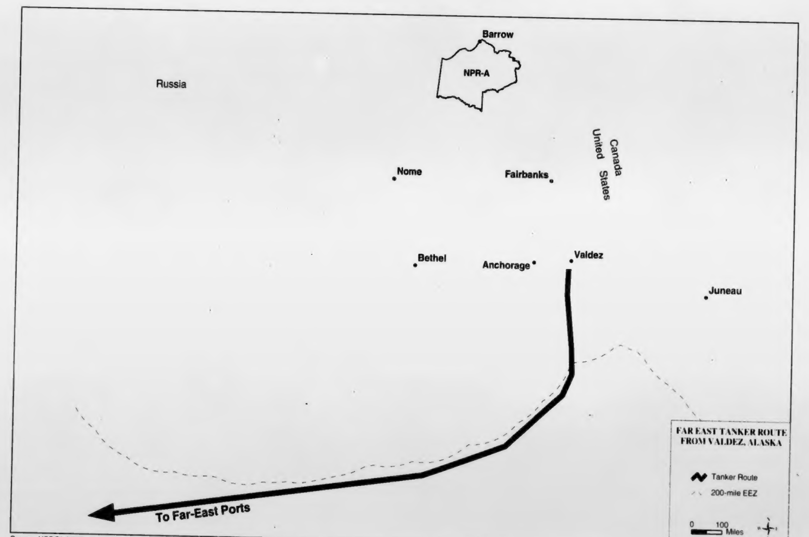
12.5X
SUPTDOCS/GPO
MAP 77



Source: USDOI, MMS, 2002

Map 97. Potential Tanker Route from Valdez to the Far East

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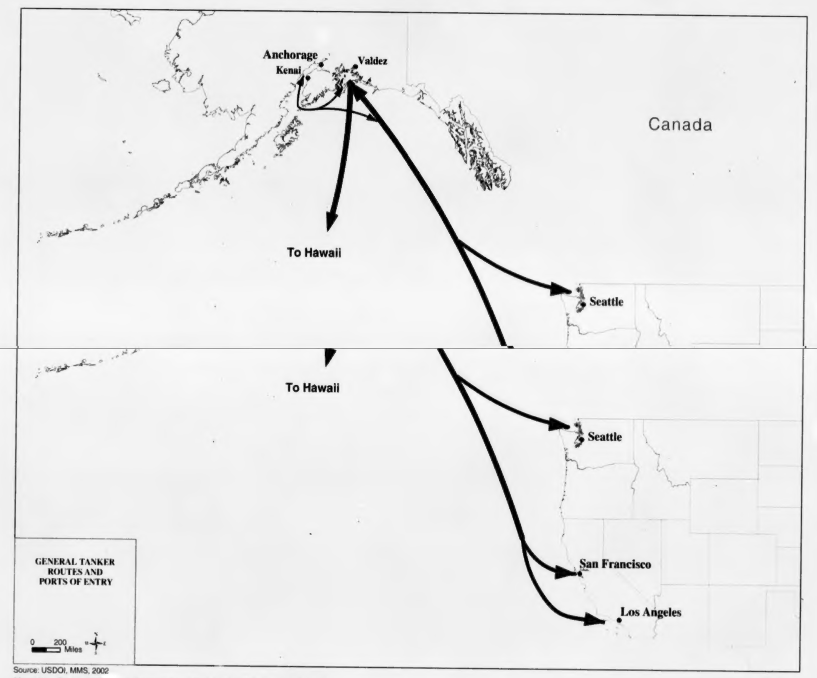
12.5X
SUPTDOCS/GPO
MAP 78

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 78



Source: USDOI, MMS, 2002

Map 98. General Tanker Routes from Valdez to U.S. Ports of Entry

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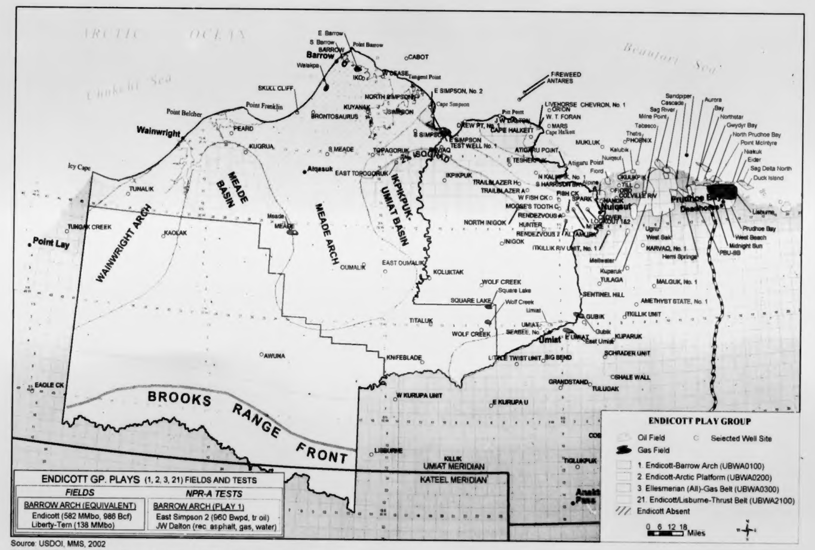
BROOKS RANGE FRONT
ENDICOTT GP. PLAYS (1, 2, 3, 21) FIELDS AND TESTS
FIELDS
BARROW ARCH (EQUIVALENT)
Endicott (582 MMbo, 986 Bcf)
Liberty-Tern (138 MMbo)
NPR-A TESTS
BARROW ARCH (PLAY 1)
East Simpson 2 (960 Bwpd, tr oil)
JW Dalton (rec. asphalt, gas, water)
UMIAT MERIDIAN
KATEEL MERIDIAN
ENDICOTT PLAY GROUP
Oil Field
Selected Well Site
Gas Field
1. Endicott-Barrow Arch (UBWA0100)
2. Endicott-Arctic Platform (UBWA0200)
3. Ellesmerian (All)-Gas Belt (UBWA0300)
21. Endicott/Lisburne-Thrust Belt (UBWA2100)
Endicott Absent
0 6 12 18 Miles

Source: USDOI, MMS, 2002

Map 99. Endicott Play Group in NPR-A (With Fields and Test Wells)

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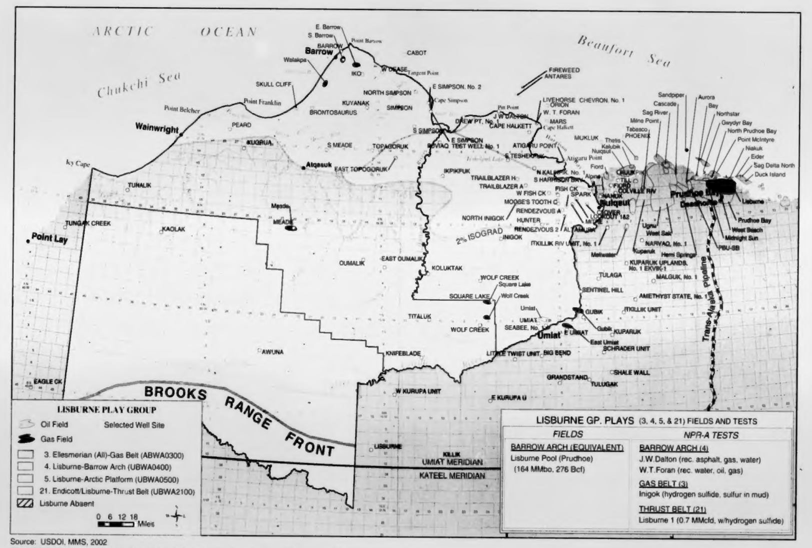
MAP 80



Source: USDOI, MMS, 2002

Map 10[illegible] Lisburne Play Group in NPR-A (With Fields and Test Wells)

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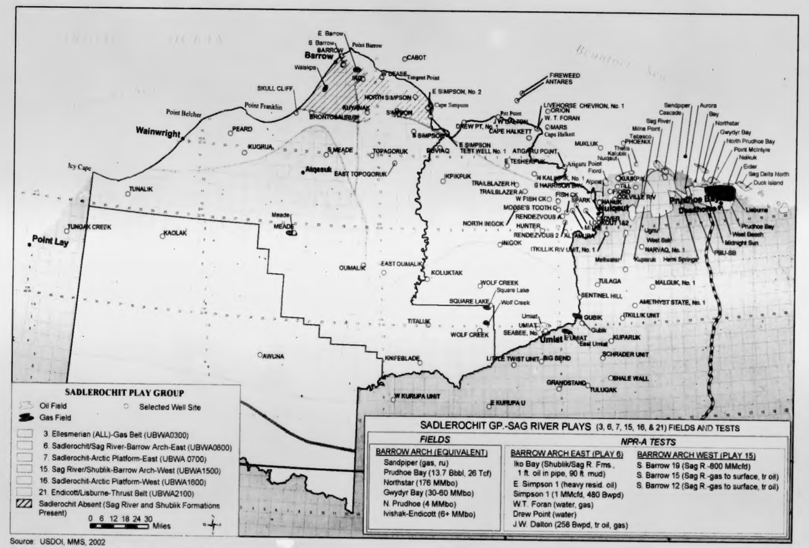
SUPTDOCS/GPO
MAP 81


Point Lay
SADLEROCHIT PLAY GROUP
Oil Field
Selected Well Site
Gas Field
3. Ellesmerian (ALL)-Gas Belt (UBWA0300)
6. Sadlerochit/Sag River-Barrow Arch-East (UBWA0600)
7. Sadlerochit-Arctic Platform-East (UBWA 0700)
15. Sag River/Shublik-Barrow Arch-West (UBWA1500)
16. Sadlerochit-Arctic Platform-West (UBWA1600)
21. Endicott/Lisburne-Thrust Belt (UBWA2100)
Sadlerochit Absent (Sag River and Shublik Formations Present)
0 6 12 18 24 30
Miles
SADLEROCHIT GP.-SAG RIVER PLAYS (3, 6, 7, 15, 16, & 21) FIELDS AND TESTS
FIELDS
NPR-A TESTS
BARROW ARCH (EQUIVALENT)
Sandpiper (gas, ru)
Prudhoe Bay (13.7 Bbbl, 26 Tcf)
Northstar (176 MMbo)
Gwydyr Bay (30-60 MMbo)
N. Prudhoe (4 MMbo)
Ivishak-Endicott (6+ MMbo)
BARROW ARCH EAST (PLAY 6)
Iko Bay (Shublik/Sag R. Fms., 1 ft. oil in pipe, 90 ft. mud)
E. Simpson 1 (heavy resid. oil)
Simpson 1 (1 MMcfd, 480 Bwpd)
W.T. Foran (water, gas)
Drew Point (water)
J.W. Dalton (258 Bwpd, tr oil, gas)
BARROW ARCH WEST (PLAY 15)
S. Barrow 19 (Sag R.-800 MMcfd)
S. Barrow 15 (Sag R.-gas to surface, tr oil)
S. Barrow 12 (Sag R.-gas to surface, tr oil)

Source: USDOI, MMS, 2002

Map 101. Sadlerochit Play Group in NPR-A (With Fields and Test Wells)

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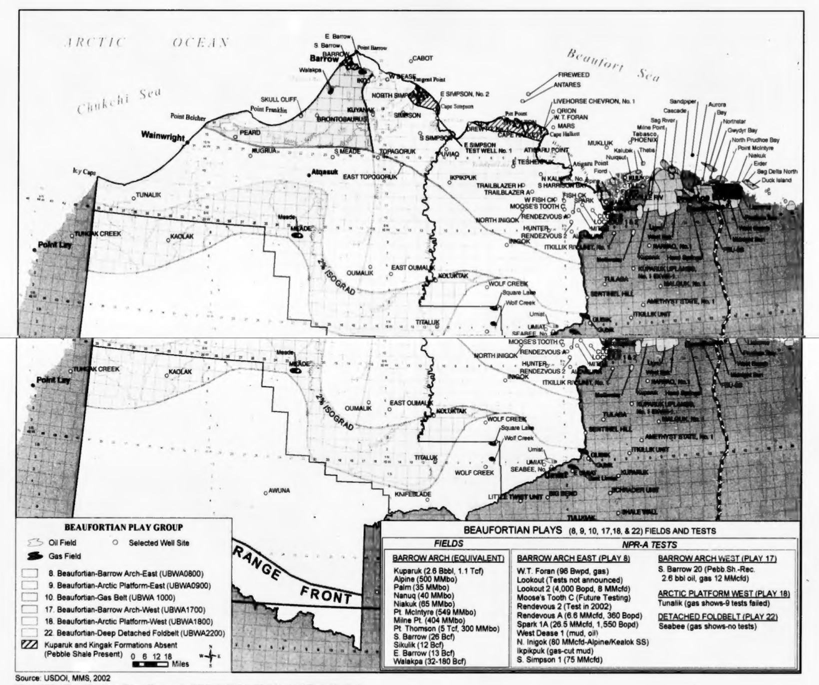
MAP 82

N 81/3/V.3 U.S. DEPARTMENT OF THE INTERIOR... NOVEMBER 2003 MAP 82



BEAUFORTIAN PLAYS (8, 9, 10, 17,18, & 22) FIELDS AND TESTS

FIELDS	NPR-A TESTS	
BARROW ARCH (EQUIVALENT)	BARROW ARCH EAST (PLAY 8)	BARROW ARCH WEST (PLAY 17)
Kuparuk (2.6 Bbbl, 1.1 Tcf) Alpine (500 MMbo) Palm (35 MMbo) Nanuq (40 MMbo) Niakuk (65 MMbo) Pt. McIntyre (549 MMbo) Milne Pt. (404 MMbo) Pt. Thomson (5 Tcf, 300 MMbo) S. Barrow (26 Bcf) Sikulik (12 Bcf) E. Barrow (13 Bcf) Walakpa (32-180 Bcf)	W.T. Foran (96 Bwpd, gas) Lookout (Tests not announced) Lookout 2 (4,000 Bopd, 8 MMcfd) Moose's Tooth C (Future Testing) Rendevous 2 (Test in 2002) Rendevous A (6.6 MMcfd, 360 Bopd) Spark 1A (26.5 MMcfd, 1,550 Bopd) West Dease 1 (mud, oil) N. Inigok (80 MMcfd-Alpine/Kealok SS) Ikpikpuk (gas-cut mud) S. Simpson 1 (75 MMcfd)	S. Barrow 20 (Pebb.Sh.-Rec. 2.6 bbl oil, gas 12 MMcfd) ARCTIC PLATFORM WEST (PLAY 18) Tunalik (gas shows-9 tests failed) DETACHED FOLDBELT (PLAY 22) Seabee (gas shows-no tests)

Source: USDOI, MMS, 2002

Map 102. Beaufortian Play Group in NPR-A (With Fields and Test Wells)

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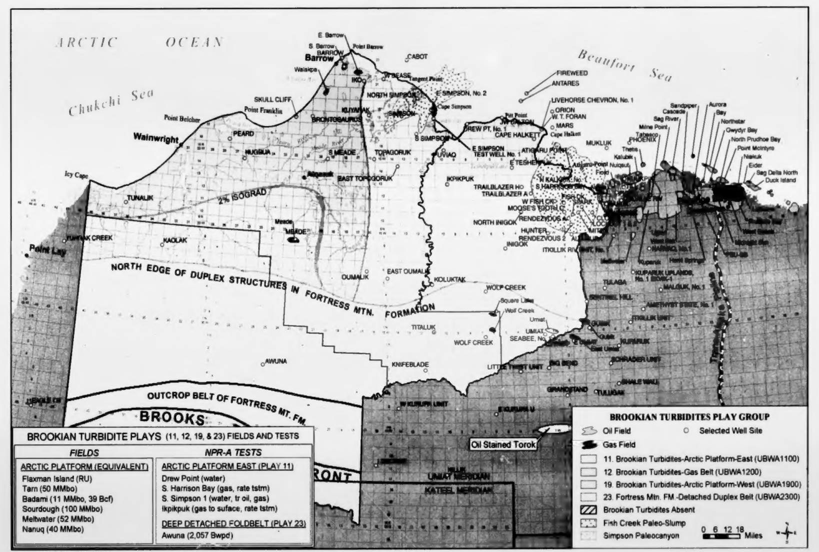
MAP 83


ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
NORTH EDGE OF DUPLEX STRUCTURES IN FORTRESS MTN. FORMATION
OUTCROP BELT OF FORTRESS MT. FM.
BROOKS
RONT
Oil Stained Torok
UMIAT MERIDIAN
KATEEL MERIDIAN
BROOKIAN TURBIDITE PLAYS (11, 12, 19, & 23) FIELDS AND TESTS
FIELDS
ARCTIC PLATFORM (EQUIVALENT)
Flaxman Island (RU)
Tarn (50 MMbo)
Badami (11 MMbo, 39 Bcf)
Sourdough (100 MMbo)
Meltwater (52 MMbo)
Nanuq (40 MMbo)
NPR-A TESTS
ARCTIC PLATFORM EAST (PLAY 11)
Drew Point (water)
S. Harrison Bay (gas, rate tstm)
S. Simpson 1 (water, tr oil, gas)
Ikpikpuk (gas to suface, rate tstm)
DEEP DETACHED FOLDBELT (PLAY 23)
Awuna (2,057 Bwpd)
BROOKIAN TURBIDITES PLAY GROUP
Oil Field
Selected Well Site
Gas Field
11. Brookian Turbidites-Arctic Platform-East (UBWA1100)
12. Brookian Turbidites-Gas Belt (UBWA1200)
19. Brookian Turbidites-Arctic Platform-West (UBWA1900)
23. Fortress Mtn. FM.-Detached Duplex Belt (UBWA2300)
Brookian Turbidites Absent
Fish Creek Paleo-Slump
Simpson Paleocanyon
0 6 12 18 Miles

Source: USDOI, MMS, 2002

Map 103. Brookian Turbidite Play Group in NPR-A (With Fields and Test Wells)

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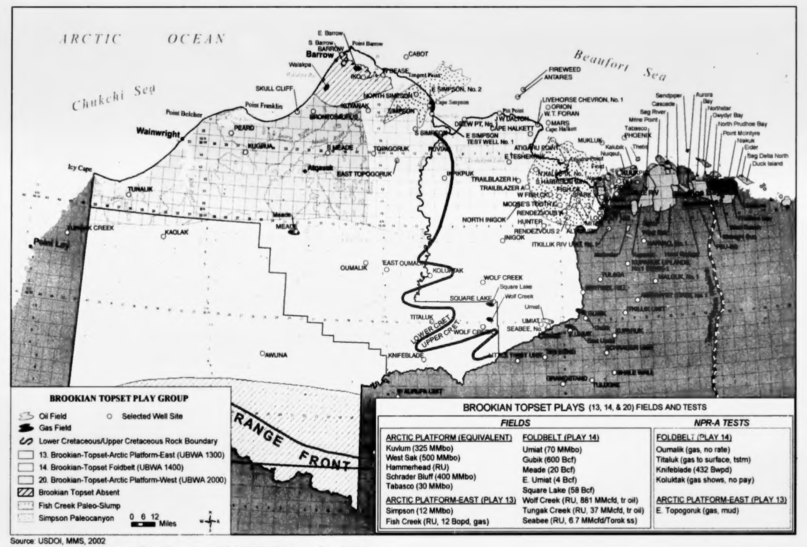

Source: USDOI, MMS, 2002

Map 104. Brookian Topset Play Group in NPR-A (With Fields and Test Wells)

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MAP 85

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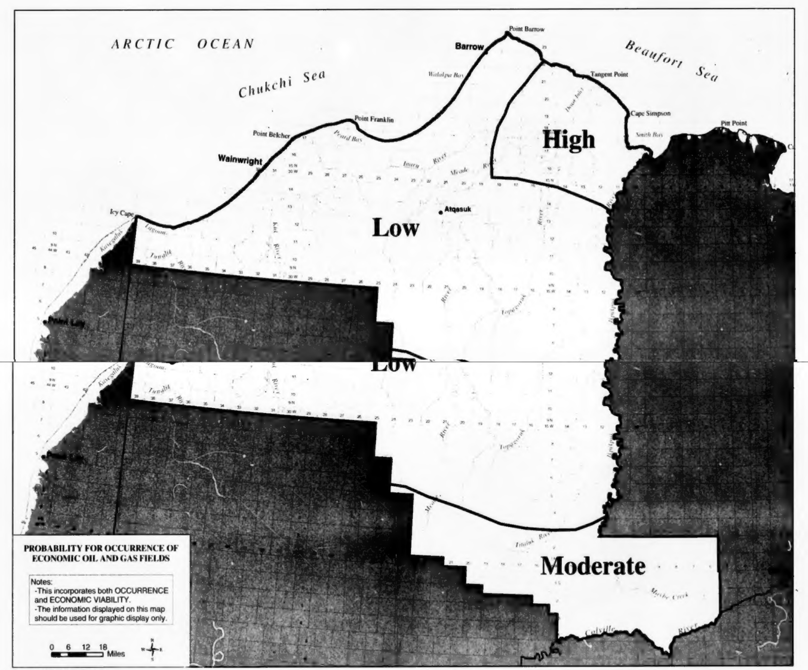
MAP 85



Source: USDOI, MMS, 2002

Map 105. Distribution of Potential Oil and Gas Resources of the Northwest NPR-A Planning Area

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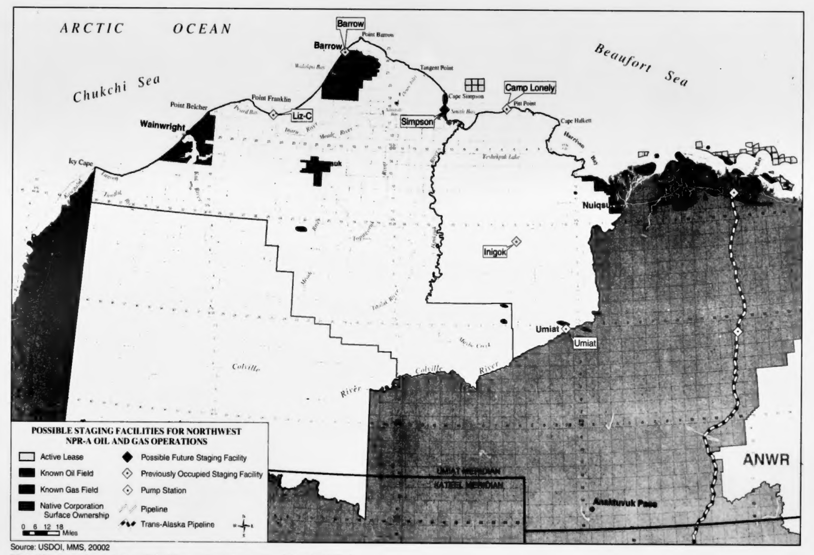
MAP 86



Source: USDOI, MMS, 20002

Map 107. Locations of Possible Oil and Gas Staging Facilities in NPR-A

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MAP 87

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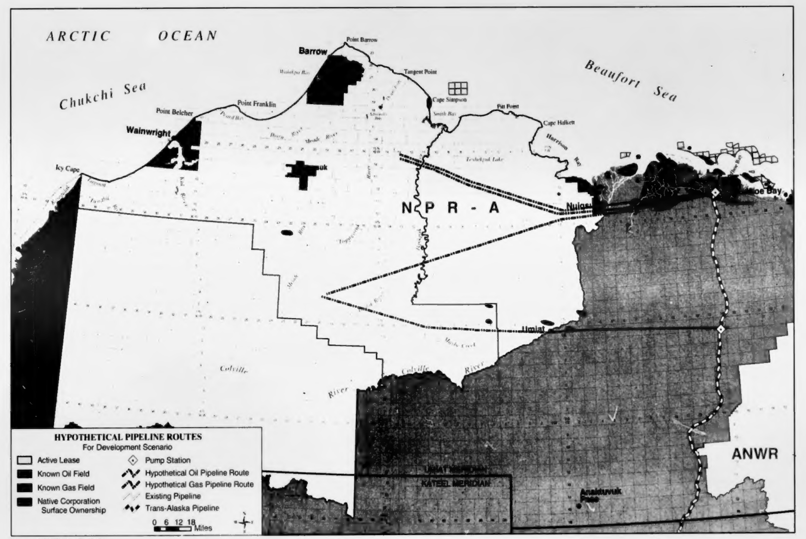

Source: USDOI, MMS, 2002

Map 108. Hypothetical Pipeline Routes for the NW NPR-A Development Scenario

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SUPTDOCS/GPO
MAP 88

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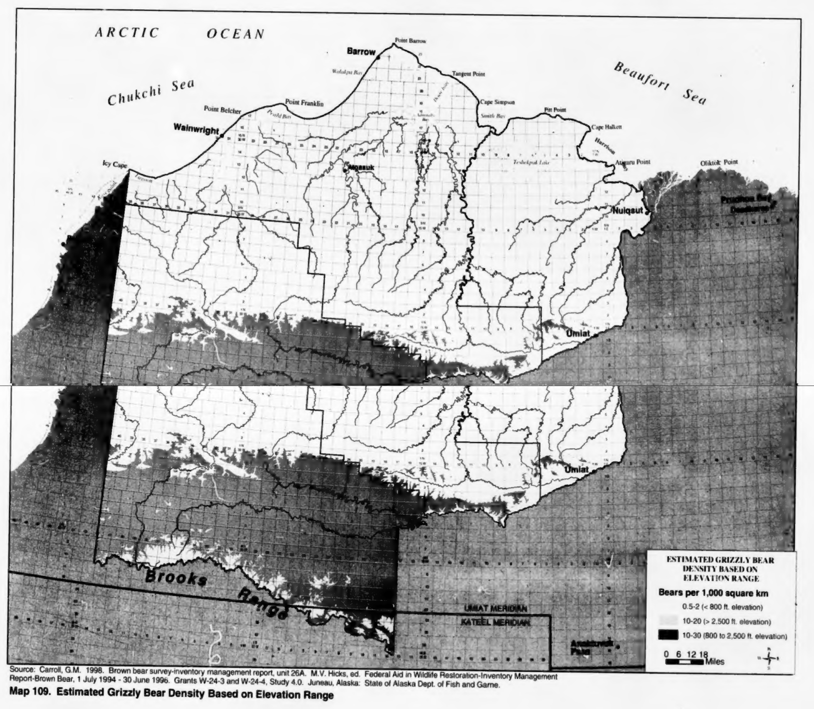
MAP 88



Source: Carroll, G.M. 1998. Brown bear survey-inventory management report, unit 26A. M.V. Hicks, ed. Federal Aid in Wildlife Restoration-Inventory Management Report-Brown Bear, 1 July 1994 - 30 June 1996. Grants W-24-3 and W-24-4, Study 4.0. Juneau, Alaska: State of Alaska Dept. of Fish and Game.

Map 109. Estimated Grizzly Bear Density Based on Elevation Range

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